



**Federal Aviation
Administration**

Environmental Assessment for the Space Coast Air and Spaceport, City of Titusville, Brevard County, Florida

April 2020

This Environmental Assessment becomes a Federal Document when evaluated, signed and dated by the responsible FAA official.

Final Environmental Assessment for Space Coast Air and Spaceport
Titusville, Florida

AGENCY: Federal Aviation Administration (FAA)

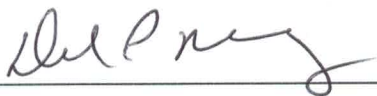
DEPARTMENT OF TRANSPORTATION, FEDERAL AVIATION ADMINISTRATION: The Titusville-Cocoa Airport Authority (TCAA) has applied for a Launch Site Operator License to operate a commercial space launch site at Space Coast Regional Airport (TIX), called Space Coast Air and Spaceport. TCAA would offer the site for the launch and landing of horizontal take-off and horizontal-landing reusable launch vehicles. Under the Proposed Action addressed in the Environmental Assessment (EA), the FAA would: (1) Issue a Launch Site Operator License to TCAA for the operation of a commercial space launch site at TIX; and (2) provide unconditional approval of the portion of the Airport Layout Plan (ALP) that shows the designation of a launch site boundary and existing and planned spaceport infrastructure. This Draft EA evaluates the potential direct, indirect, and cumulative environmental effects that may result from the Proposed Action.

PUBLIC REVIEW PROCESS: The FAA released the Draft EA for a 30-day review and held a public meeting in Titusville, FL. The FAA provided public notice of the availability of the Draft EA through the Federal Register and the FAA website. An electronic version of the Draft EA was made available on the FAA's website. The FAA has considered all comments received on the Draft EA in preparing this Final EA.

CONTACT INFORMATION: Questions regarding the Final EA can be submitted to Ms. Stacey Zee, Environmental Protection Specialist, Federal Aviation Administration, 800 Independence Ave, SW, Washington, DC 20591; email stacey.zee@faa.gov.

This EA becomes a federal document when evaluated, signed, and dated by the responsible FAA official.

Date: April 15, 2020



Daniel P. Murray
Manager, Safety Authorization Division

DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration
Office of Commercial Space Transportation
Finding of No Significant Impact
for
Environmental Assessment for the Space Coast Air and Spaceport,
City of Titusville, Brevard County, Florida

Summary

The Federal Aviation Administration (FAA) prepared the attached Final Environmental Assessment (EA) to analyze the potential environmental impacts of issuing a launch site operator license to the Titusville-Cocoa Airport Authority (TCAA) to operate a commercial space launch site at Space Coast Regional Airport (TIX) in the northern half of Brevard County, Florida. The EA was prepared in accordance with the National Environmental Policy Act of 1969, as amended (NEPA; 42 United States Code [U.S.C.] § 4321 et seq.); Council on Environmental Quality NEPA implementing regulations (40 Code of Federal Regulations [CFR] parts 1500 to 1508); FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*; and FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*.

After reviewing and analyzing available data and information on existing conditions and potential impacts, the FAA has determined that the Proposed Action would not significantly affect the quality of the human environment. Therefore, the preparation of an Environmental Impact Statement is not required, and the FAA is issuing this Finding of No Significant Impact (FONSI). The FAA has made this determination in accordance with applicable environmental laws and FAA regulations. The Final EA is incorporated by reference and is attached to this FONSI.

For any questions contact:

Stacey M. Zee, Environmental Specialist, Federal Aviation Administration, 800 Independence Ave. SW, Suite 325, Washington, DC 20591, Stacey.Zee@faa.gov, (202) 267-9305

Purpose and Need

The purpose and need are outlined in Section 1.4 of the EA.

Proposed Action

The proposed action is outlined in Section 2.1 of the EA.

Alternatives

Alternatives analyzed in detail in the EA include the Proposed Action and the No Action Alternative.

Under the No Action Alternative, the FAA would not issue a launch site operator license to TCAA for the operation of a launch site at TIX. The No Action Alternative would not introduce RLV operations at TIX and would therefore not result in changes to the human environment. It should be noted that ongoing aviation growth at TIX would continue and that future operational conditions could differ from existing conditions. The No Action Alternative would not meet the stated purpose and need.

Environmental Impacts

The potential environmental impacts from the Proposed Action and No Action Alternative were evaluated in the attached Final EA for each environmental impact category identified in FAA Order 1050.1F. Chapter 3 of the Final EA describes the affected environment and regulatory setting and identifies Visual Effects and Wild and Scenic Rivers and two impact categories are not analyzed in detail. Chapter 4 of the Final EA analyzes the potential environmental impacts and documents the finding that no significant environmental impacts would result from the Proposed Action. In addition, Chapter 4 addresses the requirements of special purpose laws, regulations, and executive orders.

A summary of the documented findings for each impact category, including requisite findings with respect to relevant special purpose laws, regulations, and executive orders, follows:

- **Air Quality**, Final EA Section 4.2. Temporary, construction-related air emissions, including Greenhouse Gas (GHG) emissions, would primarily be associated with the exhaust from vehicles and other equipment. Temporary construction-related air quality impacts, including a temporary increase in GHG emissions, would not be significant.

Operation of RLVs would cause criteria air pollutant (CAP) and hazardous air pollutant (HAP) emissions within the troposphere and stratosphere. CAP and HAP emissions from support

equipment operations would also occur. When compared to a No Action Alternative, the Proposed Action's emissions from RLV operations at TIX would not result in a significant air quality impact.

Implementation of the Proposed Action may also have indirect air quality impacts through an increase of vehicle use; however, it would not significantly affect the area's air quality or the County's attainment status for any of the six criteria pollutants.

- **Biological Resources (including Fish, Wildlife, and Plants)**, Final EA Section 4.3. There is no significant impact to Biological Resources. The Proposed Action would not result in significant impacts on plants.

Some wildlife (e.g., small mammals or reptiles) would likely be displaced from the construction Region of Influence (ROI). However, no significant impacts on general wildlife species are expected.

The FAA determined the Proposed Action "may affect, but is not likely to adversely affect," the eastern indigo snake, the only Endangered Species Act-listed species effected by the Proposed Action. The United States (U.S.) Fish and Wildlife Service (USFWS) concurred with the FAA's effect determination for the eastern indigo snake and stated that implementation of the *"Standard Protection Measures for the Eastern Indigo Snake"* would ensure no adverse effects to this species.

No impacts to bald eagles from construction or RLV launches are anticipated, as all documented nests are located further from the construction and operational ROIs than the minimum USFWS recommendation. Migratory birds could nest within the construction ROI. If construction is conducted during the April 1 to August 31 breeding season, pre-construction nesting surveys would be conducted to ensure that the Proposed Action would not result in significant impacts on migratory birds.

The operational ROI extends over habitats for marine mammals and fish in the Indian River and the Atlantic Ocean. Given that little sound is transmitted between the air-water interface, operational noise, including sonic booms, would have no effect on marine mammals and fish.

No state-protected species would be significantly impacted by the Proposed Action. Gopher tortoise burrows would be excavated, and tortoises relocated under a Gopher Tortoise Conservation Permit to avoid adverse effects to this species.

- **Climate**, Final EA Section 4.4. The Proposed Action would directly and indirectly produce GHG emissions; however, these emissions would be extremely small compared to the total GHG emissions generated in the U.S and the impact would be minimal.
- **Coastal Resources**, Final EA Section 4.5. The final review of the Proposed Action's consistency with respect to the Florida Coastal Management Program (FCMP) will be conducted after completion of the EA during the Environmental Resource Permitting phase of the project. Based on the Florida Department of Environmental Protection's preliminary determination that the Proposed Action would be consistent with the FCMP, no significant impacts to coastal resources are anticipated.
- **Department of Transportation Act, Section 4(f)**, Final EA Section 4.6. The Proposed Action would not result in a physical use of any Section 4(f) properties. The 2018 and 2023 Proposed Action day-night average sound level (DNL) 65 decibel (dB) noise contours overlap property within the Enchanted Forest Sanctuary, a Section 4(f) resource. However, noise exposure levels would remain below DNL 70 dB throughout the Sanctuary, therefore noise levels would not be significant. The other Section 4(f) resources within the vicinity of TIX would not be directly affected by construction and are not located within the area overlapped by DNL noise contours. Therefore, the Proposed Action would not result in significant impacts to Section 4(f) resources.
- **Farmlands**, Final EA Section 4.7. Construction of spaceport infrastructure would occur on soils designated by the Natural Resources Conservation Service as farmland soils of unique importance. Based on the results from the completion of Form AD-1006, the total combined score for the area that would be converted or directly impacted by the Proposed Action was 60 points, which is far below the significance threshold of 200 and 260 points. Therefore, the Proposed Action would not result in significant farmland impacts.
- **Hazardous Materials, Solid Waste, and Pollution Prevention**, Final EA Section 4.8. The impacts from Hazards Materials, Solid Waste and Pollution Prevention would not be significant. Construction under the Proposed Action would not significantly increase the quantities of hazardous materials at TIX but may generate some hazardous waste which will not exceed local capacities.

Operational activities associated with the Proposed Action would result in an increase in quantities and types of hazardous materials used at TIX. This increase would be primarily due to

the use of propellants and oxidizers related to RLV operations. No new fuel farms and/or onsite storage tanks would be required under the Proposed Action. Fuels and oxidizers would be stored and used in compliance with Title 14 CFR §420.65-70 for solid and liquid propellants. Unused liquid fuels or oxidizers in the tanker trucks would be returned to the distributor.

Under the Proposed Action, the TCAA would implement measures to ensure hazardous materials and wastes are handled, stored, and used in compliance with Federal, state, and local regulations.

- **Historical, Architectural, Archeological, and Cultural Resources**, Final EA Section 4.9. There are no significant historical or archaeological resources in the Area of Potential Effect, therefore, no impacts to historical, architectural, archeological and cultural resources are expected as a result of the Proposed Action.
- **Land Use**, Final EA Section 4.10. The Proposed Action would not result in any disruptions to surrounding communities and would be consistent with the current land uses at and in the vicinity of TIX. While operations at TIX would increase over existing conditions, the Proposed Action would not result in a change in the existing land use at and in the vicinity of TIX. Therefore, there would be no significant land use impacts.
- **Natural Resources and Energy Supply**, Final EA Section 4.11. Energy demands for lighting facilities, construction, and operation would be minor. Some water would be used for construction and operation; however, the City's Water Resources Department has indicated that there is both adequate water and sewer capacity to handle anticipated growth. Therefore, no impacts to natural resources and energy supply are expected as a result of the Proposed Action.
- **Noise and Noise-Compatible Land Use**, Final EA Section 4.12. It is not anticipated that construction would occur close enough to residential areas or sensitive receptors to cause disturbances. However, specific measures could be considered during construction to further reduce noise, including limiting the time of day heavy equipment can be operated, or ensuring that equipment is shut off when not in use.

The noise impacts from potential sonic booms modeled DNL levels are much less than the DNL 65 dBA noise exposure criteria. Therefore, the Proposed Action will not result in significant noise impacts.

- **Socioeconomics, Environmental Justice, and Children’s Environmental Health and Safety Risks,** Final EA Section 4.13. Construction and operation are expected to have limited impacts on population, employment, and housing in the area of the Proposed Action. Minor impacts on the surrounding area would likely be due to a minor increase in employment and the associated increase in traffic. No impact is anticipated in any environmental resource category for environmental justice or children’s environmental health and safety risks.
- **Water Resources (including Wetlands, Floodplains, Surface Waters, and Groundwater),** Final EA Section 4.14. The Proposed Action would avoid direct impacts to wetlands, and indirect impacts would be expected to be avoided or minor. If all appropriate permits are obtained, construction is not expected to impact surface waters. Because the Proposed Action would be unlikely to result in increased probability of loss of human life from flooding, would be unlikely to result in flood-related property damage, and would not result in notable impacts to natural and beneficial floodplain values, FAA concludes that no significant floodplain encroachment would result from the Proposed Action.

Chapter 5 of the Final EA provides an analysis of the potential cumulative impacts of the Proposed Action when added to other past, present, and reasonably foreseeable future actions. The FAA has determined that the Proposed Action would not result in significant cumulative impacts in any environmental impact category.

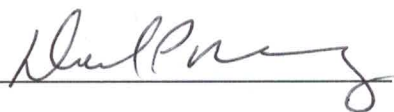
Finding

The FAA finding is based on a comparative examination of environmental impacts for each of the alternatives studied during the environmental review process. The EA discloses the potential environmental impacts for each of the alternatives and provides a full and fair discussion of those impacts. There would be no significant impacts, including no significant cumulative impacts, to the natural environment or surrounding population as a result of the Proposed Action.

The FAA believes the Proposed Action best fulfills the purpose and need identified in the Final EA. In contrast, the No Action Alternative fails to meet the purpose and need identified in the Final EA. An FAA decision to take the required actions and approvals is consistent with its statutory mission and policies supported by the findings and conclusions reflected in the environmental documentation and this FONSI.

After reviewing the Final EA and all its related materials, the undersigned has carefully considered the FAA's goals and objectives in relation to various aspects of the activities described in the Final EA, including the purpose and need to be met, the alternative means of achieving them, the environmental impacts of these alternatives, and the costs and benefits of achieving the stated purpose and need.

After careful and thorough consideration of the facts contained herein, the undersigned finds that the proposed Federal action is consistent with existing national environmental policies and objectives as set forth in Section 101 of NEPA and other applicable environmental requirements and will not significantly affect the quality of the human environment or otherwise include any condition requiring consultation pursuant to Section 102(2)(C) of NEPA.

APPROVED: 

DATE: April 15, 2020

Daniel P. Murray,
Manager, Safety Authorization Division

Note to reader:

This Environmental Assessment analyzes potential operation of three reusable launch vehicles (RLVs) at Space Coast Regional Airport: Concept X, Concept Y, and Concept Z. For various reasons the Concept Y RLV was withdrawn from the Launch Site Operators License. However, Concept Y was not removed from the Environmental Assessment as the Titusville-Cocoa Airport Authority expressed a desire to allow planning and assessment of a Concept Y RLV to remain in the Environmental Assessment because there remains a possibility that a Concept Y RLV could become a more viable option in the future. Correspondence reflecting this is included in **Appendix A** of this Environmental Assessment.

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ACRONYMS AND ABBREVIATIONS

A	ABS	Acrylonitrile Butadiene Styrene
	ACHP	Advisory Council on Historic Preservation
	AIRFA	The American Indian Religious Freedom Act of 1978
	ALP	Airport Layout Plan
	APE	Area of Potential Effect
	ARC	Airport Reference Code
	ATCT	Airport Traffic Control Tower
B	BG	Block Group
C	CAP	Criteria air pollutant
	CEQ	Council on Environmental Quality
	CFR	Code of Federal Regulations
	CH ₄	Methane
	CO	Carbon Monoxide
	CO ₂	Carbon Dioxide
	CT	Census Tract
	CWA	Clean Water Act
D	dB	Decibel
	dBA	Decibel A-weighted
	dB(C)	Decibel C-weighted
	DNL	Day Night Average Sound Level
E	EA	Environmental Assessment

ACRONYMS AND ABBREVIATIONS

	ERP	Environmental Resource Permit
	ESA	Endangered Species Act
F	FAA	Federal Aviation Administration
	FBO	Fixed-base operator
	FDEP	Florida Department of Environmental Protection
	FDOT	Florida Department of Transportation
	FEMA	Federal Emergency Management Agency
	FFWCC	Florida Fish and Wildlife Conservation Commission
	FLUCS	Florida Land Use, Cover, and Forms Classification System
	FNAI	Florida Natural Areas Inventory
	Form AD-1006	Farmland Conversion Impact Rating Form AD-1006
	FPPA	Farmland Protection Policy Act
G	GA	General Aviation
	GHG	Greenhouse Gases
	GIS	Geographic Information System
H	HAPS	Hazardous Air Pollutants
	HFCs	Hydrofluorocarbons
	HTPB	Hydroxyl-terminated Polybutadiene
	H ₂ O	Water
	H ₂ O ₂	Hydrogen Peroxide
I	ICAO	International Civil Aviation Organization
	IFR	Instrument Flight Rules
	INM	Integrated Noise Model

ACRONYMS AND ABBREVIATIONS

I	IPaC	Information for Planning and Conservation
L	LiDAR	Remote sensing technique (light and radar)
	LOS	Level of Service
	LOX	Liquid Oxygen
M	MMPA	Marine Mammal Protection Act
N	NAAQS	National Ambient Air Quality Standards
	NASA	National Aeronautics and Space Administration
	NEPA	National Environmental Policy Act
	NHPA	National Historic Preservation Act
	NMFS	National Marine Fisheries Service
	NPL	National Priority List
	NRHP	National Register of Historic Places
	N ₂ O	Nitrous oxide
	NO ₂	Nitrogen dioxide
	NO _x	Nitrogen oxides
	NOAA	National Oceanic and Atmospheric Administration
	NPDES	National Pollutant Discharge Elimination System
	NRCS	Natural Resources Conservation Service
	NWSRA	National Wild and Scenic Rivers Act
O	O ₃	Ozone
P	PAD	Public Area Distance
P	PFCs	Perfluorocarbons

ACRONYMS AND ABBREVIATIONS

	Pb	Lead
	PM	Particulate Matter
	PM _{2.5}	Particulate Matter 2.5 micrometers in diameter or smaller
	PM ₁₀	Particulate Matter 2.5 to 10 micrometers in diameter
	ppm	Parts per million
	ppb	Parts per billion
	psf	Pound per square foot
R	RCRA	Resource Conservation and Recovery Act
	ROI	Region of Influence
	RLV	Reusable Launch Vehicle
	RP-1	Rocket Propellant 1, a highly refined kerosene
	RPZ	Runway Protection Zone
	RUMBLE	Launch Vehicle Acoustic Simulation Model
S	SF ₆	Sulfur Hexafluoride
	SHPO	State Historic Preservation Office
	SO ₂	Sulfur Dioxide
	SJRWMD	St. Johns River Water Management District
	SPCC	Spill Prevention, Control, and Countermeasures
	SWPPP	Stormwater Pollution Prevention Plan
T	TAF	Terminal Area Forecast
	TCAA	Titusville Cocoa Airport Authority
	TIX	Space Coast Air and Spaceport
T	TICO	Titusville Cocoa Airport Authority

ACRONYMS AND ABBREVIATIONS

	TSCA	Toxic Substances Control Act
U	USACE	United States Army Corps of Engineers
	U.S.C.	United States Code
	USEPA	United States Environmental Protection Agency
	USFWS	United States Fish and Wildlife Service
V	VFR	Visual Flight Rules

CHAPTER 1

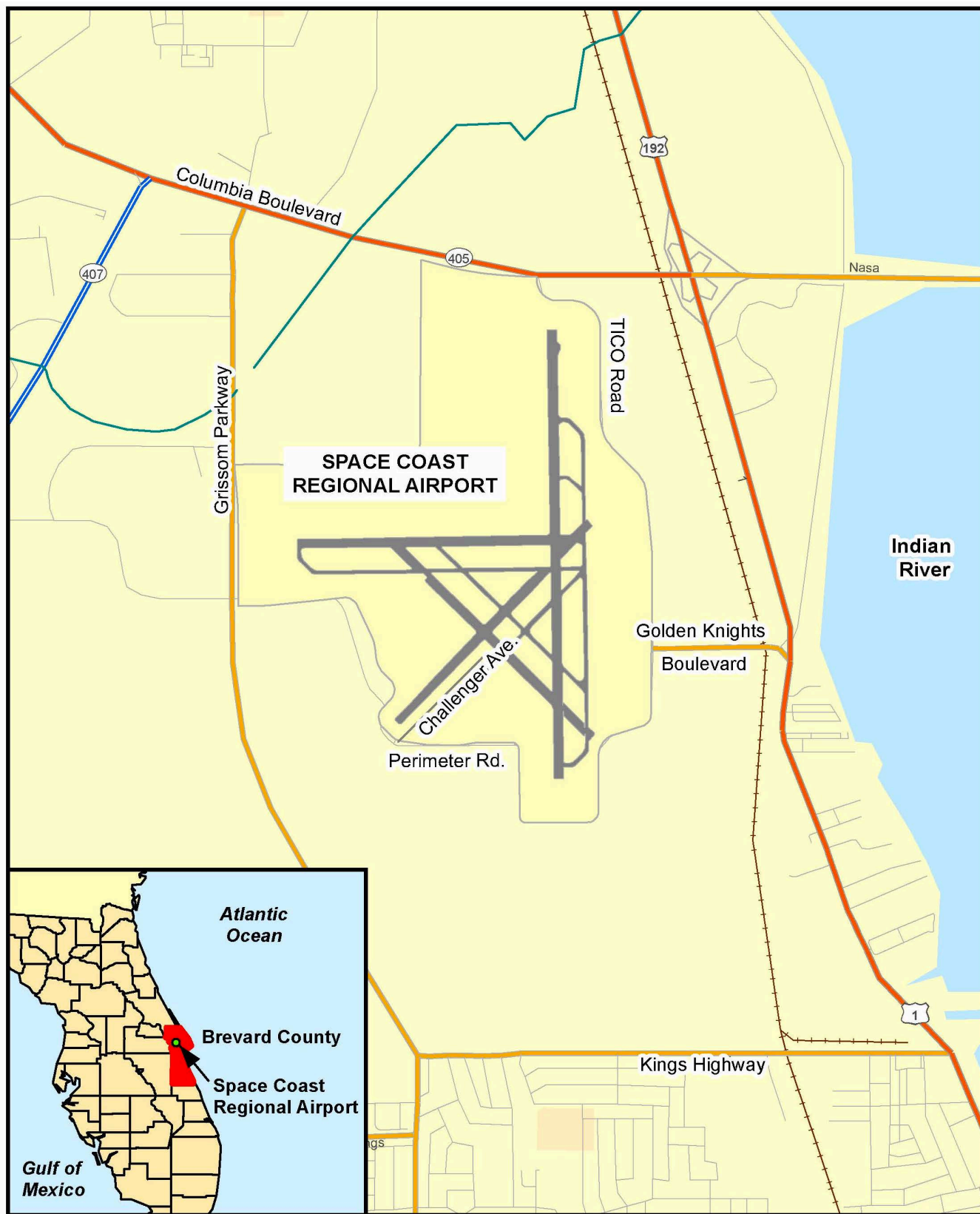
1.1 INTRODUCTION

Space Coast Regional Airport (TIX) is a General Aviation (GA) airport located within the southern limits of the City of Titusville, in the northern half of Brevard County, Florida (**Figure 1-1**). TIX is owned and operated by Titusville-Cocoa Airport Authority (TCAA). TCAA proposes to construct new infrastructure and facilities to operate the Space Coast Air and Spaceport, a commercial space launch site at TIX for the launch and landing of horizontal take-off and horizontal-landing reusable launch vehicles (RLVs). To operate a commercial space launch site, TCAA must obtain a launch site operator license from the Federal Aviation Administration (FAA). Under the Proposed Action addressed in this Environmental Assessment (EA), the FAA would:

- (1) Issue a launch site operator license to TCAA for the operation of a commercial space launch site at TIX; and,
- (2) Provide unconditional approval¹ of the portion of the Airport Layout Plan (ALP) that shows the designation of a launch site boundary and existing and planned spaceport infrastructure, including the following:
 - Construction of a 400,000 square-foot RLV development and production hangar complex with oxidizer (nitrous oxide [N₂O] and liquid oxygen [LOX]) and rocket fuel (Rocket Propellant 1 [RP-1]) tanker truck storage areas between the northwest side of Taxiway D and Perimeter Road;
 - Construction of a 400,000 square-foot apron between the proposed new hangar and Taxiway D;
 - Construction of a 350,000 square-foot parking lot adjacent to the northwest side of the proposed new hangar;
 - Construction of a 53,000 square-foot loading area adjacent to the west side of the proposed new hangar;
 - Construction of 2,000 linear feet of access roads and drives to connect the proposed new parking area to Perimeter Road;
 - Construction of a 10,000 square-foot oxidizer loading area located approximately 1,450 feet southwest of the approach end of Runway 36;

¹ Unconditional ALP approval means that environmental review has been completed and the Airport Sponsor is authorized to begin developing the project. (FAA Order 5050.4B, Paragraph 202(c)(2)). Conditional ALP approval means that the FAA has not completed the environmental review process and the Airport Sponsor is not yet authorized to begin development. (FAA Order 5050.4B, Paragraph 202(c)(1)).

Figure 1-1 Location Map



Michael Baker
INTERNATIONAL

TIX Spaceport Licensing
Environmental Assessment

LOCATION MAP

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Miles

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1-1

Figure No.

- Construction of a 1,930-linear-foot taxiway to connect the oxidizer loading area to the south end of Runway 36; and
- Construction of a 7,270-linear-foot realignment of Perimeter Road.

Additional information on the Proposed Action is provided in Chapter 2.

Construction of the spaceport infrastructure is expected to start in 2020, pending completion of this environmental review and issuance of required construction permits. For this analysis, it was assumed the earliest RLV operations would start in 2020, assuming construction is completed in 2020 and a launch vehicle operator receives an FAA license to conduct commercial space launch operations at TIX. No operator has been identified at this time.

The Proposed Action is subject to environmental review under the National Environmental Policy Act (NEPA) of 1969 as amended (42 United States Code [U.S.C.] §4321, *et seq.*). The FAA is the lead Federal agency and is preparing this EA in accordance with NEPA, Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500–1508); FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*; and FAA Order 5050.4B, *NEPA Implementing Instructions for Airport Actions*. The National Aeronautics and Space Administration (NASA) and the U.S. Air Force (USAF) are cooperating agencies on this EA. NASA and USAF provide special expertise with respect to potential environmental impacts from space launches and the operation of a launch site.

This EA evaluates the potential direct, indirect, and cumulative environmental effects that would result from the Proposed Action and reasonable alternatives, including the No Action Alternative. The successful completion of the environmental review process does not guarantee that the FAA would issue a launch site operator license to TCAA, nor does completion of the NEPA process guarantee the FAA would provide unconditional ALP approval. The project must also meet all FAA safety, risk, and financial responsibility requirements per 14 CFR Part 400 and not adversely affect the safety, utility, or efficiency of the airport per 49 U.S.C. § 47107(a)(16).

Additional environmental analysis will be required for future vehicle operators. When a launch operator applies to the FAA for a license to operate at TIX, the FAA will develop a new or supplemental EA that will include a public notification and review period. If the FAA grants a launch site operator license to TCAA for the operation of TIX, it in no way ensures or guarantees that the FAA would grant a subsequent license to an operator of a vehicle at the site.

1.2 BACKGROUND

With the retirement of NASA’s space shuttle program in 2011 and the increasing focus on the privatization of the space industry in the United States, the need for licensed spaceports to serve the commercial space industry is growing. A number of companies are researching, developing, and testing launch vehicles with the goal of providing opportunities for space tourism and carrying commercial and government payloads to suborbital altitudes. An FAA launch site operator license would enable TCAA to offer TIX as a site for commercial space launch vehicle operators to conduct launches of horizontal RLVs.

1.2.1 Airport Designation

TIX holds a Class IV Airport Operating Certificate under 14 CFR Part 139, and as part of the National Plan of Integrated Airport System and based on current activity levels, is designated a General Aviation (GA) airport of regional significance.² The GA category is comprised of the largest number of airports in the U.S. system³ and includes, but is not limited to, flight training, time-sensitive air cargo services, business travel, emergency medical services, aerial firefighting, law enforcement and border control, agricultural functions, and scheduled services.⁴ At TIX, GA services include flight training, helicopter flight training, aircraft fueling services, aircraft rentals, aerial tours/sightseeing services, and major aircraft frame repair.

1.2.2 Aviation Activity Forecasts

Aviation activity forecasts were developed for the non-RLV activity that is anticipated at TIX between 2015 and 2023 (**Table 1.1**). The total operations numbers were obtained from the FAA’s Operational Network⁵ database and the breakdown of operations by aircraft type was determined by reviewing FAA Traffic Flow Management System Counts percentages and previous forecasting efforts for TIX. The forecasts were developed for the ALP update and were subsequently used in this EA’s noise analysis. Total operations are forecast to increase from 108,872 in 2015 to 113,012 by 2023.

² FAA, National Plan of Integrated Airport System, 2013-2017, https://www.faa.gov/airports/planning_capacity/npas/reports/historical/media/2013/npas2013Narrative.pdf (March 10, 2019).

³ FAA, “Airport Categories”, http://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/categories/ November 23, 2018 (March 10, 2019).

⁴ FAA, *General Aviation Airports: A National Asset*, May 2012, pp. 4-5, http://www.faa.gov/airports/planning_capacity/ga_study/media/2012AssetReport.pdf, May 2012 (March 10, 2019).

⁵ FAA Operations & Performance Data, <https://aspm.faa.gov/> (March 10, 2019).

1.2.3 Existing Facilities

TIX is situated on approximately 1,100 acres, located five miles south of downtown Titusville. The airfield is located approximately six miles east of Interstate 95, one mile west of U.S. Highway 1, and is five miles from the NASA John F. Kennedy Space Center. On-airport access is provided by TCAA Road, Golden Knights Boulevard, and Perimeter Road to the east and Challenger Avenue to the southwest (**Figure 1-1**).

Table 1.1 Forecast of Non-RLV Operations by Aircraft Type (2015–2023)							
Year	Total	SE Piston	ME Piston	Turboprop	Jet	Helicopter	Military
2015	108,872	51,093	17,030	398	702	39,194	455
2018	110,389	51,274	17,091	405	783	40,381	455
2023	113,012	51,570	17,190	417	939	42,441	455
Sources: Michael Baker International, 2015; FAA Traffic Flow Management System Counts, 2015; FAA TAF, 2015; FAA ETMSC, 2015; FAA OPSNET, 2015							

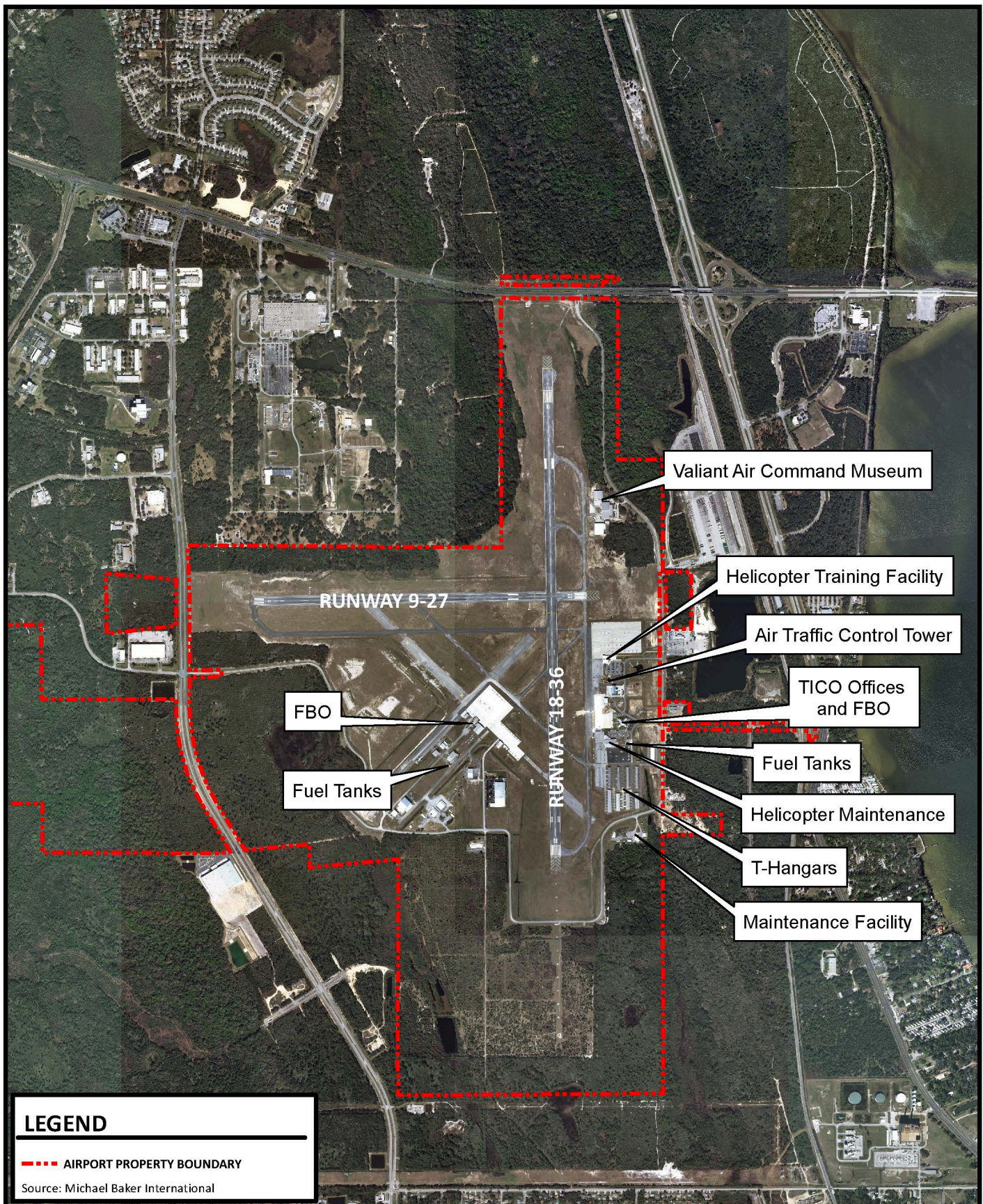
The towered airfield includes Runway 18-36, which is 7,319 feet long and 150 feet wide, and Runway 9-27, which is 5,000 feet long and 100 feet wide (**Table 1.2**). Runway 18-36 has an Airport Reference Code of C-III, which means that it can accommodate aircraft with approach speeds of less than 141 knots and with maximum tail heights less than 45 feet and wingspans less than 118 feet. Runway 9-27 has an Airport Reference Code of C-II and can accommodate aircraft with approach speeds of less than 141 knots and with maximum tail heights less than 30 feet and wingspans less than 79 feet.

The airfield is divided into three general areas:

- East side – the area located east of Runway 18-36;
- Southwest side – the area located south of Runway 9-27 and west of Runway 18-36; and
- Northwest side – the area located north of Runway 9-27 and west of Runway 18-36 (**Figure 1-2**).

Table 1.2 TIX Existing Facilities		
Facility	Runway 18-36	Runway 9-27
Runway Length	7,319 Feet	5,000 Feet
Runway Width	150 Feet	100 Feet
Airport Reference Code	C-III	C-II
Critical Aircraft	B727-200/MD-87/Bombardier Global Express	Grumman Gulfstream III
Approach Category	Non Precision Runway 18 Precision Runway 36	Non Precision Runways 9 and 27

Figure 1-2 Existing Airfield Facilities



The east side of the airfield is highly active and includes a wide array of facilities, such as Valiant Air Command aircraft museum; the world's largest civilian helicopter training school; the TIX Airport Traffic Control Tower (ATCT); an administration building that houses a fixed-base operator's office and service counter and the TCAA offices; two 30,000-gallon above ground fuel tanks, one containing Jet A and the other containing 100LL Avgas; a helicopter maintenance facility; numerous hangars and 70 T-hangar units; and the TIX maintenance facility (**Figure 1-2**).

A majority of the development on the southwest side of the airfield is related to the second full-service fixed-based operator. There are several buildings, hangars, ramp areas, and subtenants that occupy the southwest side of the airfield, as well as two 12,000-gallon above ground fuel tanks, one containing Jet A fuel and the other containing 100LL Avgas.

Currently, there are no aviation or non-aviation related facilities constructed on the northwest side of TIX.

1.2.4 RLVs

TCAA is applying to the FAA for a launch site operator license for TIX.

Three vehicles are currently analyzed in this EA:

- Concept X RLVs, which take off and land on a runway using jet engines like an airplane but, after reaching suitable airspace, transition to rocket engine power to achieve suborbital flight altitudes;
- Concept Y RLVs, which take off under rocket engine power and then make an unpowered, gliding landing on a runway ; and,
- Concept Z Launch System, which is a two-part launch system that uses a separate carrier aircraft during takeoff. Once the carrier aircraft reaches suitable airspace, the rocket detaches from the carrier aircraft and rocket engines are ignited. The carrier aircraft would return to the launch site and land under jet engine power. After completion of the rocket-powered phase of flight, the rocket would make an unpowered, gliding landing on a runway.

While this EA discusses three concept RLVs, only Concept X and Concept Z are included in TCAA's license application. The Concept Y RLV is not a viable option for operation at TIX at this time.

1.3 ROLE OF THE FAA

As authorized by Executive Order (EO) 12465, *Commercial Expendable Launch Vehicle Activities* (49 *Federal Register* 7099, 3 CFR, 1984 Comp., p. 163), and chapter 509 of Title 51 of the U.S. Code, the FAA Office of Commercial Space Transportation licenses and regulates U.S. commercial space launch and reentry activity, as well as the operation of non-federal launch and reentry sites. The FAA Office of Commercial Space Transportation's mission is to ensure protection of the public, property, and the national security and foreign policy interests of the United States during commercial launch or reentry activities, and to encourage, facilitate, and promote U.S. commercial space transportation.

Pursuant to 49 U.S.C. § 47107(a)(16), the FAA Administrator (under authority delegated from the Secretary of Transportation) must approve any revision or modification to an ALP before the revision or modification takes effect. The Administrator's approval reflects a determination that the proposed alterations to the airport, reflected on the ALP revision or modification, do not adversely affect the safety, utility, or efficiency of the airport.

1.3.1 FAA Licenses and Permits

A license to operate a launch site authorizes a licensee to offer its launch site to a launch operator for each launch point and launch vehicle type identified in the license application and upon which the licensing determination is based. A launch site operator license remains in effect for five years from the date of issuance unless surrendered, suspended, or revoked before the expiration of the term and is renewable upon application by the licensee (14 CFR Part 420.43).

The FAA issues separate licenses for operation of launch vehicles. Therefore, potential launch operators would need to obtain individual launch licenses from the FAA before launching from TIX.

The FAA issues launch licenses for the operation of RLVs (14 CFR Part 431). An RLV Operator license is valid for a two-year renewable term and authorizes a licensee to launch and reenter, or otherwise land, any of a designated family of RLVs within authorized parameters, including launch sites and trajectories, transporting specified classes of payloads to any reentry site or other location designated in the license. A licensee can renew its license by submitting an application to the FAA at least 90 days before the license expires. An RLV mission-specific license authorizes a licensee to launch and reenter, or otherwise land, one model or type of RLV from a launch site approved for

the mission to a reentry site or other location approved for the mission. An RLV mission-specific license expires upon completion of all activities authorized by the license or the expiration date stated in the license, whichever occurs first.

1.3.2 Airport Layout Plan

An ALP is an FAA-approved drawing or series of drawings that depicts both existing facilities and planned development for an airport. The ALP must depict the following:

- Boundaries and proposed additions to all areas owned or controlled by the sponsor for airport purposes;
- The location and nature of existing and proposed airport facilities and structures; and
- The location on the airport of existing and proposed non-aviation areas and improvements.

The Federal actions for this EA include the unconditional approval of a modification to the ALP to reflect the launch site boundary and existing and planned spaceport infrastructure, as described in **Section 1.1**.

1.3.3 Letter of Agreement

As a component of the launch site operator license application process, TCAA would enter into a Letter of Agreement with all appropriate Air Traffic Control facilities to establish procedures for the issuance of a Notice to Airmen prior to a launch and for closing of air routes during the launch window and other such measures as the FAA Air Traffic Control office deems necessary to protect public health and safety. The FAA Air Traffic Organization would participate in and provide inputs to the process of determining flight corridors and RLV operating areas, along with the FAA Office of Commercial Space Transportation, the U.S. Air Force Eastern Range and affected military air traffic control agencies, and spaceport airspace users.

1.4 PURPOSE AND NEED

The purpose of TCAA's proposal to operate a commercial space launch site is to allow TCAA to offer TIX as a launch site for commercial space launch operations involving horizontally launched RLVs. TCAA's need for the proposed commercial space launch site is to boost the local economy, which has been negatively impacted by the termination of the Space Shuttle program.

1.5 AIRSPACE AND AIRPORTS

Controlled airspace is airspace of defined dimensions in which air traffic control service is provided to aircraft operating under both instrument flight rules (IFR) or visual flight rules (VFR). TIX is centered in Class D airspace established from the surface to 1,900 feet above ground level. The Federal Contract Air Traffic Control Tower at TIX provides VFR air traffic control service during the hours that Class D airspace is effective. In addition, TIX underlies busy IFR airways and IFR jet routes. Launching an RLV on a suborbital trajectory involves a flight path that has the potential to conflict with established aircraft traffic airways and routes. Airspace would be cleared for departure and return using existing Air Traffic Control procedures. Coordination would be required with entities including the TIX Tower, FAA Eastern Service Area, Miami Air Route Traffic Control Center, FAA Orlando Terminal Radar Approach Control Facilities, and the USAF Eastern Test Range to establish RLV departure/arrival procedures and an RLV Operating Area.

1.6 PUBLIC INVOLVEMENT

The FAA released the Draft EA for public review in December 2019 and held a public meeting on January 8, 2020 at the Ralph Poppell Airport Administration Building at Space Coast Regional Airport in Titusville, FL.

A number of agencies and Native American Tribes were contacted regarding the preparation of this EA. **Appendix B** lists the agencies and tribes consulted and includes copies of correspondence with these agencies.

When a launch operator applies to the FAA to operate from TIX, the FAA will prepare a new or supplemental EA that will include public notification and review period. The FAA generated a distribution list as part of the development of this EA. The distribution list includes all public meeting attendees and commenters on the EA. The FAA will use this list as an initial notification list for future environmental reviews once a launch operator proposes to operate from the site.

1.7 OTHER ENVIRONMENTAL REQUIREMENTS

In addition to NEPA, other laws, regulations, permits, and licenses may be applicable to the Proposed Action. Specifically, the Proposed Action may require any or all of the following or other environmental approvals:

- A Standard Dredge and Fill permit from the U.S. Army Corps of Engineers (USACE) pursuant to Section 404 of the Clean Water Act;

- An Individual Environmental Resource Permit from the St. Johns River Water Management District;
- A National Pollutant Discharge Elimination System (NPDES) Permit for a Large Construction Site from the Florida Department of Environmental Protection (FDEP);
- A Gopher Tortoise Conservation Permit from the Florida Fish and Wildlife Conservation Commission (FWWCC);
- A City of Titusville Stormwater Management Permit; and
- A City of Titusville Floodplain Development Permit.

CHAPTER 2

PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

TCAA is proposing to operate a commercial space launch site at TIX in Brevard County, Florida, and to offer the site for the operation of horizontally launched and horizontally landed suborbital RLVs. Under the Proposed Action, the FAA would:

- issue a launch site operator license to TCAA to operate a commercial launch site at TIX; and
- unconditionally approve to the updated ALP that shows the designation of the launch site boundary and existing and planned launch site infrastructure.

A launch site operator license is valid for five years and can be renewed upon request. The estimated timeframe for the Proposed Action is 2020 through 2025.

Additional information on licenses is available in **Section 1.3.1**.

TCAA does not have an agreement with a launch operator at this time. However, future licensed launch activities at TIX could include the operation of horizontal RLVs that carry space flight participants, scientific experiments, or other payloads. The maximum number of annual launch operations would be 50. The maximum number of launches from 2020 through 2025 would not exceed 250 launches.

Operation of a commercial space launch site would require construction of the following:

- A 400,000 square-foot RLV development and production hangar complex with concrete oxidizer (N₂O and LOX) and rocket fuel (RP-1) tanker truck storage areas between the northwest side of Taxiway D and Perimeter Road;
- A 400,000 square-foot concrete apron between the proposed new hangar and Taxiway D;
- A 350,000 square-foot asphalt parking lot adjacent to the northwest side of the proposed new hangar;

- A stormwater treatment facility adjacent to the parking lot sized to treat stormwater runoff from the proposed new development areas;
- A 53,000 square-foot concrete loading area adjacent to the west side of the proposed new hangar;
- 2,000 linear feet of asphalt access roads and drives to connect the proposed new parking area to Perimeter Road;
- Fencing around the RLV facilities to secure the airside areas of TIX;
- A 10,000 square-foot concrete oxidizer loading area located approximately 1,450 feet southwest of the approach end of Runway 36;
- A 1,930-linear-foot asphalt taxiway to connect the oxidizer loading area to the south end of Runway 36; and,
- 7,270-linear-foot asphalt realignment of Perimeter Road (**Figure 2-1A and Figure 2-1B**).

The following sections detail the operational requirements and characteristics of the proposed concept RLVs and the proposed infrastructure.

2.1.1 Horizontal Takeoff and Landing Vehicles

TCAA has identified three types of suborbital, horizontally launched and landed RLVs that could launch from TIX: Concepts X, Y, and Z. The proposed RLVs would not require runway lengths greater than the existing 7,319-foot runway at TIX.

2.1.1.1 Concept X RLV

Concept X vehicles take off and land using jet engines, but after reaching an altitude of approximately 40,000 to 55,000 feet, transition to rocket engine power. In 2012, Rocket Crafters Incorporated announced plans to design and manufacture hybrid rocket propulsion products and dual propulsion flight vehicles at TIX. Its approximate dimensions include a length of 45 feet, a 29-foot wingspan, and a height of 12 feet. It would take off using two turbofan jet engines that use Jet-A fuel. Its four hybrid rocket engines would use a solid fuel consisting of acrylonitrile butadiene styrene (ABS) plastic and aluminum and a liquid oxidizer such as N_2O . The preliminary estimate of gross liftoff weight is 48,000 pounds.



Rocket Crafters Sidereus – Concept X
Source: Rocket Crafters, August 2014

Figure 2-1a Proposed Spaceport Operator Facility

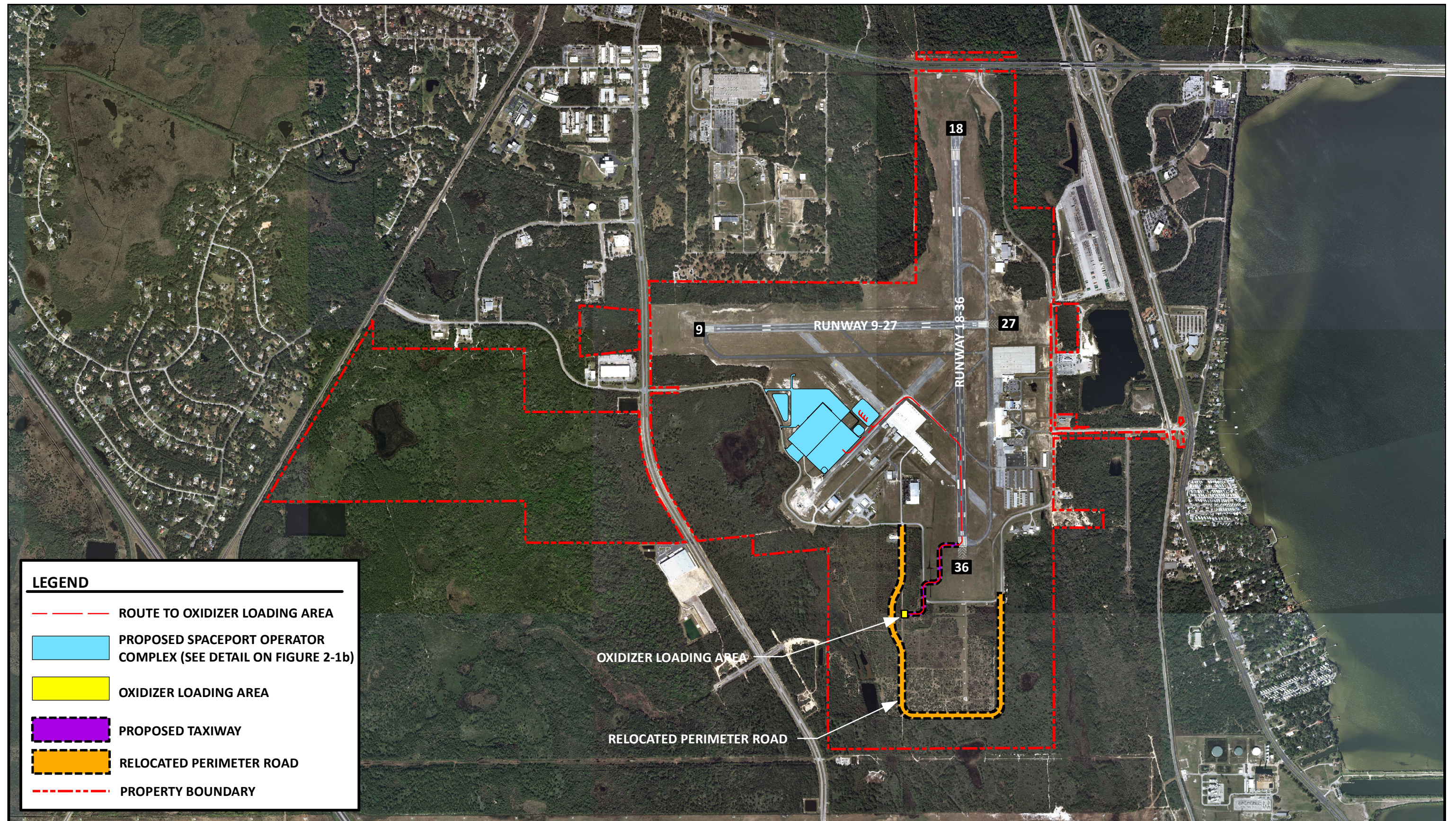
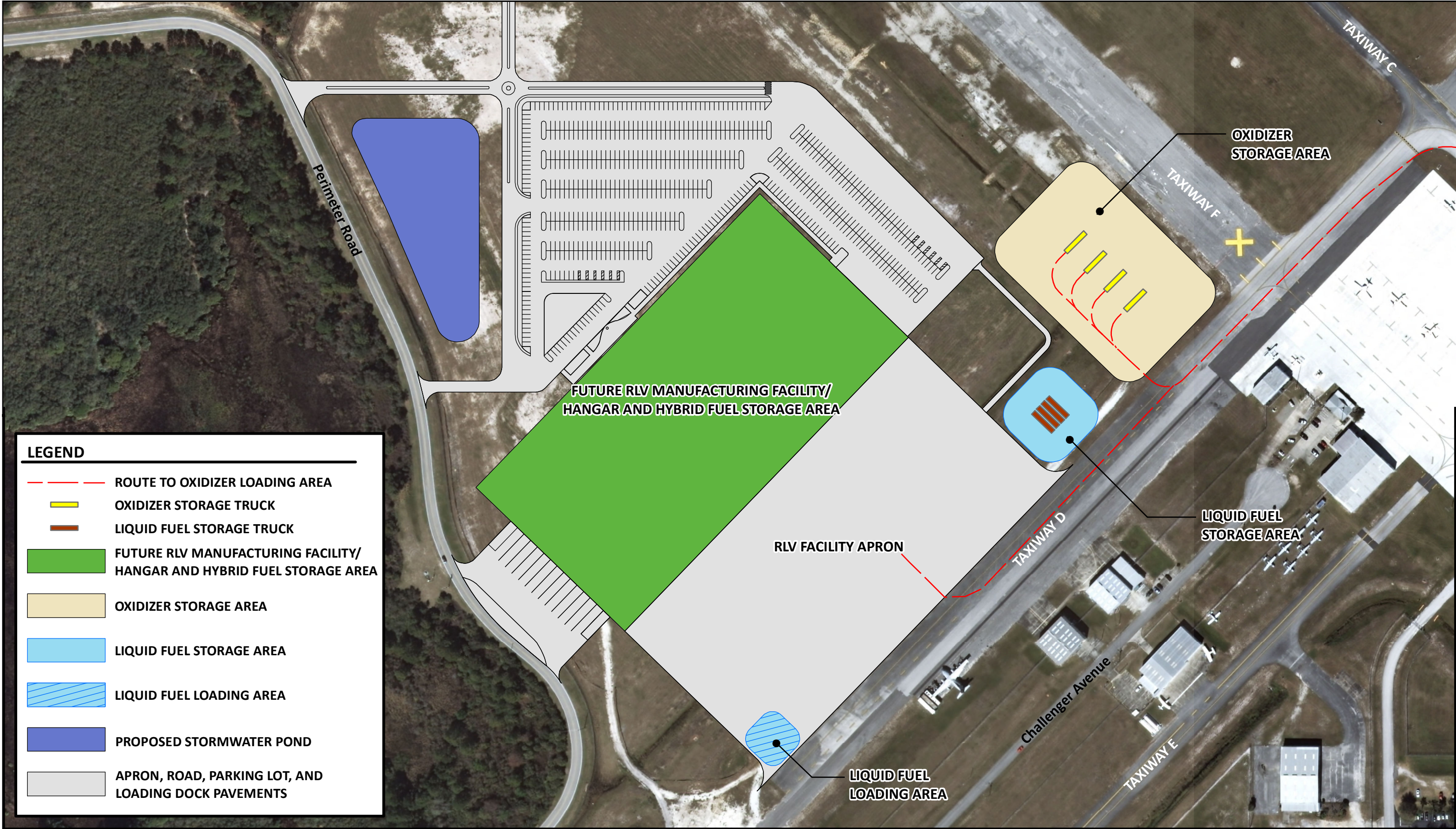


Figure 2-1b Proposed Spaceport Operator Complex



Total flight time per launch is estimated at less than one hour. Estimated maximum altitude is reported to be 100 kilometers.¹

2.1.1.2 Concept Y RLV

Concept Y vehicles take off under rocket engine power and then glide to an unpowered landing on a runway. An example of a Concept Y RLV is the XCOR Lynx Mark I.² The Lynx uses rocket engines fueled with RP-1 and uses LOX for oxidizer. This suborbital RLV is designed to carry one pilot and one space flight participant. The Lynx Mark I is approximately 28 feet long, 10 feet high, and has a 27-foot wingspan.³ Total mass of the vehicle is reported as 10,692 pounds.⁴ The Lynx's rocket engines provide a total thrust of 11,600 pounds of force and the flight duration is approximately 20 minutes.⁵



XCOR Lynx – Concept Y

Source: XCOR, April 2012

Pavement composition of Runway 18-36 would have to be evaluated for the Concept Y RLV, because this vehicle takes off under rocket power. The existing surface is asphalt concrete. The USAF has published several Engineering Technical Letters related to high temperature exposure on pavements. Most of their research attempts to approach protection of existing pavements and implementation of research to develop new heat-resistant pavements. The research done has shown that conventional Portland cement concrete experiences rapid deterioration at temperatures above 350 degrees Fahrenheit (°F) and Portland cement concrete may break down immediately at temperatures above 500 °F. Most asphalt becomes liquid between 250 and 300 °F. Above 350 °F, the hydrocarbons in asphalt binder burn off and it ages rapidly becoming very brittle.⁶ Given the sensitivity of both Portland cement concrete and asphalt concrete pavements to high temperatures, further analysis of each proposed RLV must be done to ensure compatibility of the RLV with existing pavements as the characteristics of the RLV and its propulsion system will vary greatly depending on the concept and its design.

¹ Rocket Crafters, August 6, 2014.

² XCOR is no longer developing the Lynx launch vehicle, however the Lynx vehicle's dimensions and propellants are used in the EA to assess the potential impacts of the operation of a Concept Y vehicle. Upon receiving a license application for a Concept Y vehicle, the FAA would compare the application with this EA to determine if it falls within the scope of this EA or if supplemental environmental analysis is necessary.

³ RS&H, FAA Launch Site Operator License Application for Space Coast Air and Spaceport, May 2018.

⁴ FAA, *Annual Compendium of Commercial Space Transportation: 2014*, http://www.faa.gov/about/office_org/headquarters_offices/ast/media/FAA_Annual_Compendium_2014.pdf, February 2015, (March 4, 2019), p.53.

⁵ *Ibid*, p. 53.

⁶ Department of Defense, Engineering Technical Letter 14-4, August 18, 2014.

2.1.1.3 Concept Z RLV

Concept Z RLVs are a two-part launch system that consists of a reusable carrier vehicle and a mated rocket. The carrier vehicle carries the mated rocket to an altitude of approximately 50,000 feet, where it would release the rocket and the rocket engines would ignite. In this concept, the carrier vehicle is considered the first stage of the launch system, and the mated rocket is considered the second stage (the two together comprise the RLV). After completion of the rocket-powered phase of flight, the rocket glides to an unpowered landing on the runway. Similar to Concept X, the Concept Z launch system requires Jet A-fuel for the carrier vehicle. The rocket uses a hybrid motor powered by solid fuel and a liquid oxidizer.

A representative Concept Z RLV is Virgin Galactic's SpaceShipTwo. SpaceShipTwo is air-launched from a carrier vehicle, called WhiteKnightTwo, at approximately 50,000 feet. WhiteKnightTwo, which uses Jet-A fuel, is approximately 78 feet long, and has a wingspan of 140 feet and a tail height of 26 feet.⁷ SpaceShipTwo is approximately 60 feet long with a wingspan of 27 feet and a tail height of 18 feet (with feather down).



Virgin Galactic – Concept Z
Source: Virgin Galactic, April 2012

SpaceShipTwo's hybrid rocket engine uses N₂O as an oxidizer and an HTPB (hydroxyl-terminated polybutadiene) solid fuel. SpaceShipTwo is reported to have a total thrust of 60,000 pounds of force.⁸ The carrier vehicle and rocket would both be piloted. The flight duration is approximately 51 minutes.

2.1.1.4 Reusable Launch Vehicle Requirements

TCAA proposes to offer TIX for horizontal launches of Concepts X, Y, and/or Z RLVs. Specific details regarding the vehicle requirements are included in **Table 2.1**.

⁷ Virgin Galactic Human Spaceflight Vehicles Fact Sheet. February 2016.

⁸ FAA, *Annual Compendium of Commercial Space Transportation: 2014*, http://www.faa.gov/about/office_org/headquarters_offices/ast/media/FAA_Annual_Compendium_2014.pdf, February 2015, (March 4, 2019), p.56.

Table 2.1 Vehicle and Facility Requirements			
Requirement	RLV		
	Concept X	Concept Y	Concept Z
<i>Runway Length</i>	7,319 feet	7,000 feet	7,049 feet
<i>Propellant</i>	Jet power = 8,800 pounds of Jet-A fuel Rocket propellant = 8,100 pounds of ABS plastic/aluminum fuel; 9,900 pounds of N ₂ O oxidizer	Rocket propellant = 2,100 pounds of RP-1 fuel; 5,300 pounds of LOX oxidizer	Carrier vehicle = max of 21,100 pounds of Jet-A fuel Rocket = 2,500 pounds of HTPB solid fuel; 13,000 pounds of N ₂ O oxidizer
<i>Hangar Space and Infrastructure</i>	400,000 square-foot RLV manufacturing building/hangar; 400,000 square-foot apron; 53,000 square-foot loading area; 10,000 square-foot oxidizer loading area; 28,450 square foot liquid fuel storage area (tanker truck parking); 129,000 square-foot oxidizer storage area (tanker truck parking)		
<u>Notes:</u> ABS = acrylonitrile butadiene styrene; HTPB = hydroxyl terminated polybutadiene; LOX = liquid oxygen; N ₂ O = nitrous oxide; RP-1 = Rocket Propellant 1 <u>Sources:</u> Rocket Crafters, August 6, 2014; XCOR, 2015; Virgin Galactic Human Spaceflight Vehicles Fact Sheet, 2016.			

2.1.2 Operation of Horizontal Takeoff and Landing Vehicles

Proposed RLV horizontal takeoff and landing operations could begin in 2020 and continue into 2025, which coincides with the 5-year launch site operator license duration. For the purposes of this study, a maximum of 50 launch operations per year were assumed. These 50 launches could consist of one concept vehicle type (e.g., all Concept X launches) or a combination of each concept type. However, the total number of launches per year would not exceed 50. This total includes licensed launches and launches that may occur under an experimental permit. Therefore, over the 5-year period of the launch site operator license, the total number of launches would not exceed 250 launches. For the purposes of analysis, five percent of annual operations were assumed to occur at night (between 10:00 p.m. and 7:00 a.m.), which would equate to approximately 3 nighttime operations per year and a total maximum of 15 nighttime operations over the 5-year site license duration.

The activities associated with Concepts X, Y, and Z RLV operations include pre-flight activities, launch, and post-flight activities, as described below.

2.1.2.1 Pre-Flight Activities

Pre-flight activities applicable to all three RLV concept vehicles would include air traffic coordination; vehicle assembly; engine checkout; and propellant, pilot, and passenger loading. The public area distance (PAD: the minimum distance between a public area and an explosive hazard facility) would be observed upon commencement of oxidizer transfer into the RLV at the oxidizer loading area. Once the RLV is fueled and certified for operation by the licensed operator, spaceflight participants (passengers, if the flight has any) would be loaded and doors would be closed for flight. Once clearance is received from the tower, access to the runway by other users of the airport would be restricted, and TCAA would conduct a visual inspection and foreign object debris sweep of the runway in accordance with AC 150/5370-10G and 150/5370-2F. During this time, the RLV would taxi or be towed to the runway end for final pre-flight procedures as dictated by the licensed operator. Throughout the launch operation and until the RLV is staged for launch at the runway end, the ATCT would control regular airport traffic to ensure it does not conflict or encroach upon the PAD. Notices to Airmen (NOTAMs) would be issued to warn airport users of upcoming launch operations.

The airport's visual inspection and foreign object debris sweep of the runway are expected to take approximately 10 to 20 minutes. Therefore, airport operations would be limited to Runway 9-27 and taxiways outside of the PAD for no more than 20 minutes. Once the RLV is moved to the runway end and the foreign object debris sweep commences, airport operations would be further limited to taxiways outside the PAD with closure of airport traffic on both runways for a maximum of an additional 10 to 20 minutes.

Preplanning

Launch operators would be required to notify TCAA before a planned launch. TCAA, in turn, would coordinate operations with the control tower chief. TCAA would notify the launch operator of other activities at TIX to resolve potential activity conflicts. TCAA would also notify the appropriate airspace scheduling agencies, in accordance with the Letter of Agreement. Coordination may also be required with U.S. Navy Fleet Air Control and Surveillance Facility Jacksonville.

Flight and ground support crews would rehearse mission activities prior to each launch within the RLV manufacturing facility/hangar. Runway 18-36 would be temporarily closed to other aircraft during pre- and post-launch activities. Runway 9-27 would remain open, but aircraft using Runway 9-27 may experience some delays during RLV takeoffs and

landings. A discussion of the potential effects of the Proposed Action on airspace and airports is provided in **Chapter 1**.

Propellant Loading

Concept X RLV

The solid fuel grain for the hybrid propulsion system would be installed into the spacecraft at the RLV manufacturing facility/hangar prior to launch (**Figure 2-1b**). Shortly before launch, the RLV would be towed out of the manufacturing facility/hangar to the liquid fuel loading area on the RLV facility apron and receive Jet-A fuel to top off the tanks. The vehicle would then taxi or be towed along the route shown on **Figure 2-1a** to the oxidizer loading area southwest of the Runway 36 threshold, where the N₂O tanker truck and any required portable filtering/pumping equipment would be located. N₂O would be added to the RLV. The RLV would then taxi or be towed to the Runway 36 threshold for final check-out activities.

Concept Y RLV

Prior to launch, the RLV would be towed from the RLV manufacturing facility/hangar to the liquid fuel loading area on the RLV facility apron and the fuel tank would be filled with RP-1. After fueling is complete, the vehicle would be towed along the route shown on **Figure 2-1a** to the oxidizer loading area southwest of the Runway 36 threshold, where the LOX tanker truck and any required portable filtering/pumping equipment would be located. LOX would be added to the RLV. The RLV would then be towed to the Runway 36 threshold for final check-out activities.

Concept Z RLV

The solid fuel grain for the hybrid propulsion system would be installed into the RLV within the RLV manufacturing facility/hangar, and the rocket would be attached to the carrier aircraft within the manufacturing facility/hangar before launch. The carrier aircraft with the attached rocket would be towed out of the hangar to the liquid fuel loading area on the RLV facility apron, and the carrier aircraft would be topped off with Jet-A fuel. The carrier aircraft would then taxi along the route shown on **Figure 2-1a** to the oxidizer loading area, southwest of the Runway 36 threshold, where the N₂O truck and any required portable filtering/pumping equipment would be located. N₂O would be added to the rocket. The carrier aircraft would then taxi to the Runway 36 threshold for final check-out activities.

Safety Clearance and Launch Cancellations

Prior to loading oxidizer, whether taxiing under its own jet engine power (Concept X), taxiing under jet engine power of the carrier aircraft (Concept Z), or being towed (Concept Y), the RLVs would operate under the same safety precautions as any other aircraft maneuvering around the airfield, and other aircraft at TIX would not be required to observe any special safety setbacks.

Special setbacks would be observed once the RLV arrives at the oxidizer loading area and loading of the oxidizer onto the RLV is initiated. This setback is established in the explosive site plan for the launch site operator license. The oxidizer loading area is located more than 1,440 feet from Runway 18-36 and more than 1,550 feet from its parallel taxiway, Taxiway A.

If inclement weather occurs during RLV pre-launch activities, the RLV would be removed from the runway to the oxidizer loading area, oxidizer would be removed from the RLV, and the launch would be cancelled.

Passenger Loading

After final systems and safety checks, spaceflight participants would be loaded onto the RLV at the oxidizer loading area. Passenger boarding procedures include:

- Arrival and departure of RLV stairs or ladder;
- Docking and undocking of RLV stairs or ladder;
- Arrival and departure of passenger carrying vehicle;
- Boarding of spaceflight participants;
- Securing of passenger cabin;
- Final RLV pre-flight checks; and
- Presentation of passenger safety and emergency procedures.

RLV Runway Operating Area

The RLV runway operating area, which is the runway identified for RLV operations, is Runway 18-36. The boundaries of the RLV runway operating area are within the TIX property limits. Activities that occur within the RLV runway operating area consist of:

- Final RLV pre-flight checklist;
- Air traffic control communications; and
- RLV takeoff and landing.

RLV Takeoff

Final flight preparations and systems check would be completed at the oxidizer loading area. Final flight preparations would be vehicle specific and would be detailed in the application process associated with the license for each vehicle. After completion of final flight preparations, support vehicles and personnel would clear the area, and the pilot would call the tower for clearance to take off on Runway 36. Once cleared, the RLV would be towed or would taxi to the south end of Runway 18-36 (**Figure 2-1a**). After the final flight preparations are completed and clearance is received from air traffic control, the RLV would take off.

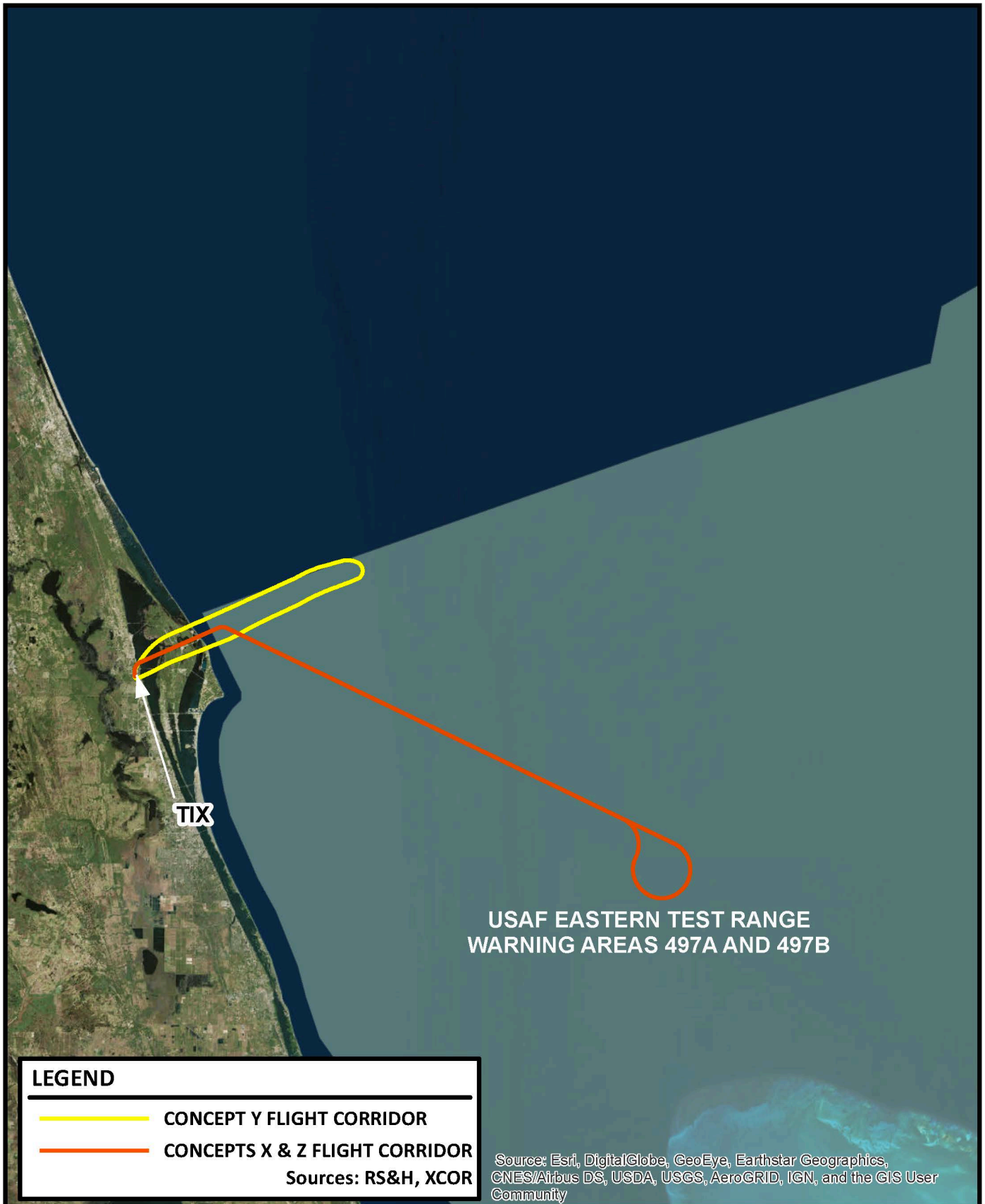
2.1.2.2 Flight Profile

The proposed flight profile for all three concept vehicles includes takeoff, flight, and landing. Standard flight times would be less than 60 minutes for Concept X vehicles; 25 to 30 minutes for Concept Y vehicles; and approximately 120 minutes for Concept Z vehicles. Each RLV would take off horizontally from Runway 18-36. Departure from Runway 18-36 would initially be at a northern trajectory, then would shift to the northeast to avoid populated areas north of TIX, and to proceed toward airspace within the USAF Eastern Test Range (Warning Areas 497A and 497B) (**Figure 2-2**). Each concept vehicle would pass across Merritt Island northeast of TIX headed toward the open ocean and away from any populated areas.

Concept X

After the pilot receives clearance, the RLV would take off from Runway 18-36 to the north and then would make an easterly turn to follow the flight corridor depicted on **Figure 2-2** to the USAF Eastern Test Range. The vehicle would ascend to approximately 55,000 feet to the rocket engine ignition point. The rocket engine would be ignited and the jet engine would be shut down. The vehicle would ascend under rocket power for 90 to 120 seconds and then the rocket engine would be shut down. The vehicle would continue to coast upward to its apogee at approximately 350,000 feet. The vehicle would follow a ballistic descent reentry and begin the final phase of the gliding flight back to TIX. Prior to landing, excess oxidizer may be released from the RLV, if necessary. Although the return to TIX would be achieved primarily by unpowered gliding, the RLV has the capability to restart its jet engines and make corrections to its approach if needed. The RLV would land horizontally on Runway 18-36.

Figure 2-2 Potential RLV Flight Corridors and Operating Areas



Concept Y

After the pilot receives clearance to take off, the rocket engines of the vehicle would be simultaneously ignited. The RLV would take off to the north from Runway 18-36 and then make an immediate easterly turn and ascend within the USAF Eastern Test Range following the flight corridor depicted on **Figure 2-2**. The vehicle would ascend rapidly to an altitude of approximately 190,000 feet, at which point the engine would shut off. The RLV would continue to coast upward to its apogee at approximately 330,000 feet. The vehicle would follow a ballistic descent reentry and begin the final phase of the gliding flight back to TIX. Prior to landing, excess oxidizer may be released from the RLV, if necessary. The RLV would glide to an unpowered horizontal landing on Runway 18-36.

Concept Z

After the pilot receives clearance to take off, the carrier aircraft, with the attached rocket (the two together comprise the RLV), would take off to the north from Runway 18-36 under jet engine power. The RLV would make an easterly turn following the flight corridor depicted on **Figure 2-2** and proceed to the USAF Eastern Test Range, while climbing to an altitude of 50,000 feet. At 50,000 feet, the rocket would separate from the carrier aircraft and the rocket's engine would be ignited. After approximately 65 seconds, the solid fuel grain would be consumed, and the engine would shut down. The launch vehicle would continue to coast upward to its apogee at approximately 330,000 feet. The RLV would make a controlled descent and re-entry into the earth's atmosphere begin the final phase of the gliding flight back to TIX. Prior to landing, excess oxidizer may be released from the RLV, if necessary. Finally, the vehicle would glide to an unpowered horizontal landing on Runway 18-36. The carrier aircraft would also return to TIX and make a powered aircraft landing.

2.1.2.3 Post-Flight Activities

The RLVs would brake to a final stop. The Concept X and Y RLVs would be towed off the runway. For the Concept Z RLV, the rocket would be towed off the runway, but the carrier aircraft would taxi off the runway under jet engine power. During most RLV operations, all oxidizer would be either consumed during the flight, or it would be purged from the vehicle during the descent prior to landing. Unused fuel would remain on the RLV, whether due to an abort of the flight or in the case of an off nominal flight. For operations where all oxidizer is expended or expelled prior to landing, no hazardous post-flight operations would be required. Additional post-flight activities would include:

- safety checks;
- relocation of the RLV to the spaceport operator complex;
- pilot and passenger disembarking;

- post-flight checkouts and inspections; and
- airfield inspections.

Under 14 CFR Part 139, airport operators would be required to conduct thorough airfield inspections before resuming passenger carrying traffic. Once the RLV crosses the landing threshold, Airport Operations would request clearance onto the runway to conduct a visual inspection. The inspection would be expected to take no more than 20 minutes. Once all vehicles have cleared the active runway and the inspection is completed, Airport Operations would make the determination to resume normal operations but keep the runway end closed until the RLV can be inspected, secured, and towed back to the spaceport ramp. Once the RLV is cleared from the runway end, the runway would be re-opened for normal airport operations. This operation would be expected to take no more than one hour. The exact time required for this operation would be evaluated during the RLV operator license application process to incorporate the individual requirements of the RLV proposed for operation.

2.1.2.4 Launch Failures

For each flight track and vehicle, TCAA would work with the launch operator and the FAA to ensure public safety according to regulations in 14 CFR Part 431. FAA regulations, as defined in 14 CFR Parts 431 and 420, set minimum public safety risk thresholds for granting a license. The launch operator would be responsible for developing an emergency response plan that addresses launch failures.

TCAA has proposed that all nominal trajectories (i.e., the trajectory that a vehicle would fly if all vehicle aerodynamic parameters are exactly as expected) will avoid densely populated areas. In the unlikely event of a launch failure, the debris impacts would be expected to be contained within the hazard area as defined by the risk analysis included in the application. The potential impacts from launch failures are discussed under the environmental impact categories that could be potentially affected by a launch failure, including biological resources (**Section 4.3**); hazardous materials, solid waste, and pollution prevention (**Section 4.8**); and water resources (**Section 4.14**).

2.1.3 Construction Activities Associated with Spaceport Operations at TIX

As shown in **Figure 2-1b**, the following project phases and components would be implemented and/or constructed as part of the Proposed Action:

Phase I, estimated to begin construction in 2020

- Construction of a 400,000 square-foot RLV manufacturing facility/hangar;
- Construction of a 129,000 square-foot oxidizer tanker truck parking area northeast of the RLV manufacturing facility/hangar and northwest of Taxiway D;
- Construction of a 28,000 square-foot liquid rocket fuel tanker truck parking area between the RLV manufacturing facility/hangar and the northwest side of Taxiway D;
- Construction of a 400,000 square-foot apron between the RLV manufacturing facility/hangar and Taxiway D;
- Construction of a 350,000 square-foot parking lot adjacent to the north side of the RLV manufacturing facility/hangar;
- Construction of a stormwater treatment facility adjacent to the parking lot sized to treat stormwater runoff from the proposed new development areas;
- Construction of a 53,000 square-foot loading area adjacent to the southwest side of the RLV manufacturing facility/hangar;
- Construction of fencing around the RLV facilities to secure the airside areas of TIX; and,
- Construction of 2,000 linear feet of access drives to connect the proposed new parking area to Perimeter Road.

Phase II, components estimated to begin construction in 2020 and continue through 2021

- Construction of a 10,000 square-foot oxidizer loading area located approximately 1,450 feet southwest of the south end of Runway 36;
- Construction of a 1,930-linear-foot taxiway to connect the oxidizer loading area to the south end of Runway 36; and
- Construction of a 7,270-linear-foot realignment of Perimeter Road.

2.2 ALTERNATIVES TO THE PROPOSED ACTION

NEPA, the CEQ Regulations, and FAA Orders 1050.1F and 5050.4B require an analysis of alternatives that satisfy the purpose of and need for Federal action. Descriptions of the alternatives to the Proposed Action, including a No Action Alternative, are provided below. For reasons discussed below, only the Proposed Action and No Action Alternative are carried forward for detailed analysis in this EA.

2.2.1 No Action Alternative

A No Action Alternative must be considered in detail under NEPA. Under the No Action Alternative, the FAA would not issue a launch site operator license to TCAA for the

operation of a launch site at TIX. The No Action Alternative would not introduce RLV operations at TIX and would therefore not result in changes to the human environment. It should be noted that ongoing aviation growth at TIX would continue and that future operational conditions could differ from existing conditions. Under the No Action Alternative, previously approved airport development could be constructed.

The No Action Alternative would not meet the purpose of and need for federal action. However, this alternative is retained to serve as the baseline for analysis as required by NEPA, CEQ regulations, and FAA Orders 1050.1F and 5050.4B.

2.2.2 Alternatives Considered but Dismissed from Detailed Analysis

The following screening criteria were used to determine whether various action alternatives would be carried forward for detailed analysis:

- The ability to meet the FAA’s purpose of and need for Federal action (as described in **Section 1.4**);
- The ability to meet TCAA’s purpose of and need for the project (as described in **Section 1.4**);
- Comparatively low population density along the flight path in order to comply with 14 CFR Part 420;
- Comparatively lower disturbance to habitat; and
- Comparatively lower construction costs.

With these screening criteria in mind, alternative sites were examined by TCAA. This section describes alternative sites considered by TCAA, which for the reasons described below, were found to be imprudent. These alternatives were not carried forward for further analysis in this EA.

2.2.2.1 Alternative 1: Vehicles Launched from Other Sites and Landing at TIX

This alternative includes only the landing of RLVs that are launched from other FAA-licensed launch sites

Alternative 1 would not meet TCAA’s purpose of and need for the project. Alternative 1 would not allow TCAA to offer TIX as a launch site for horizontally-launched RLVs in order to boost the local economy. Therefore, this alternative was not assessed further in the EA.

2.2.2.2 Alternative 2: Alternative Airport/Spaceport Locations

Two other TCAA-managed airports that could boost the local economy were investigated, including Arthur Dunn Airpark and Merritt Island Airport.

In order for Arthur Dunn Airpark or Merritt Island Airport to accommodate the runway length requirements of the proposed RLVs (**Table 2.1**) and maintain access control of the spaceport facility, TCAA would need to acquire land and extend the airport's respective runway. TCAA would also need to acquire additional land for the spaceport infrastructure. The land acquisition and runway extensions, in addition to constructing the spaceport infrastructure, would result in greatest construction costs to TCAA.

In summary, RLV flight paths from either alternative airport location would not meet the criteria of being located in an area of comparatively low population density, and this alternative would have the largest construction costs among the alternatives. Therefore, this alternative was not assessed further in the EA.

2.2.2.3 Alternative 3: Other On-Airport Locations

Alternative 3 includes developing the spaceport infrastructure, as described above for the Proposed Action, at another location within TIX property. Similar to the Proposed Action, this alternative would meet both the FAA's and TCAA's purpose of and need for action.

As previously described, the proposed spaceport facility encompasses approximately 40 acres. Under a similar configuration, the proposed development could be accommodated on TIX property closer to Grissom Parkway. This would locate the facility further from the airfield, which would require the construction of additional infrastructure (i.e., new connector taxiways and access roads) to link the spaceport facility to the existing airfield and result in additional wetland and protected species impacts.

Taking into consideration the additional clearing and site preparation that would be required, the additional potential for endangered species impact, the additional taxiway construction that would be required, and the additional cost in comparison to the Proposed Action, it was concluded that Alternative 3 would not be prudent and thus was not assessed further in the EA.

2.2.3 Alternatives to the Proposed Action's Taxiway Connecting the Oxidizer Loading Area to Runway 36

Early in the planning phase, two additional options for the 1,930-linear-foot taxiway connecting the oxidizer loading area to the south end of Runway 36 were considered in addition to the Proposed Action's proposed taxiway alignment. This taxiway would be for

RLV use only and low-profile barriers, signage, and other appropriate measures that would be implemented to ensure that unauthorized aircraft do not enter the area. Safety, potential environmental impacts, and cost/feasibility factored into the selection of the proposed taxiway alignment. The proposed taxiway alignment and two options are shown in **Figure 2-3**.

The proposed taxiway alignment minimizes impacts on wetlands and surface waters. It is also the shortest alignment at 1,930 feet long and minimizes the amount of impervious surface and is the most cost-effective alignment to construct.

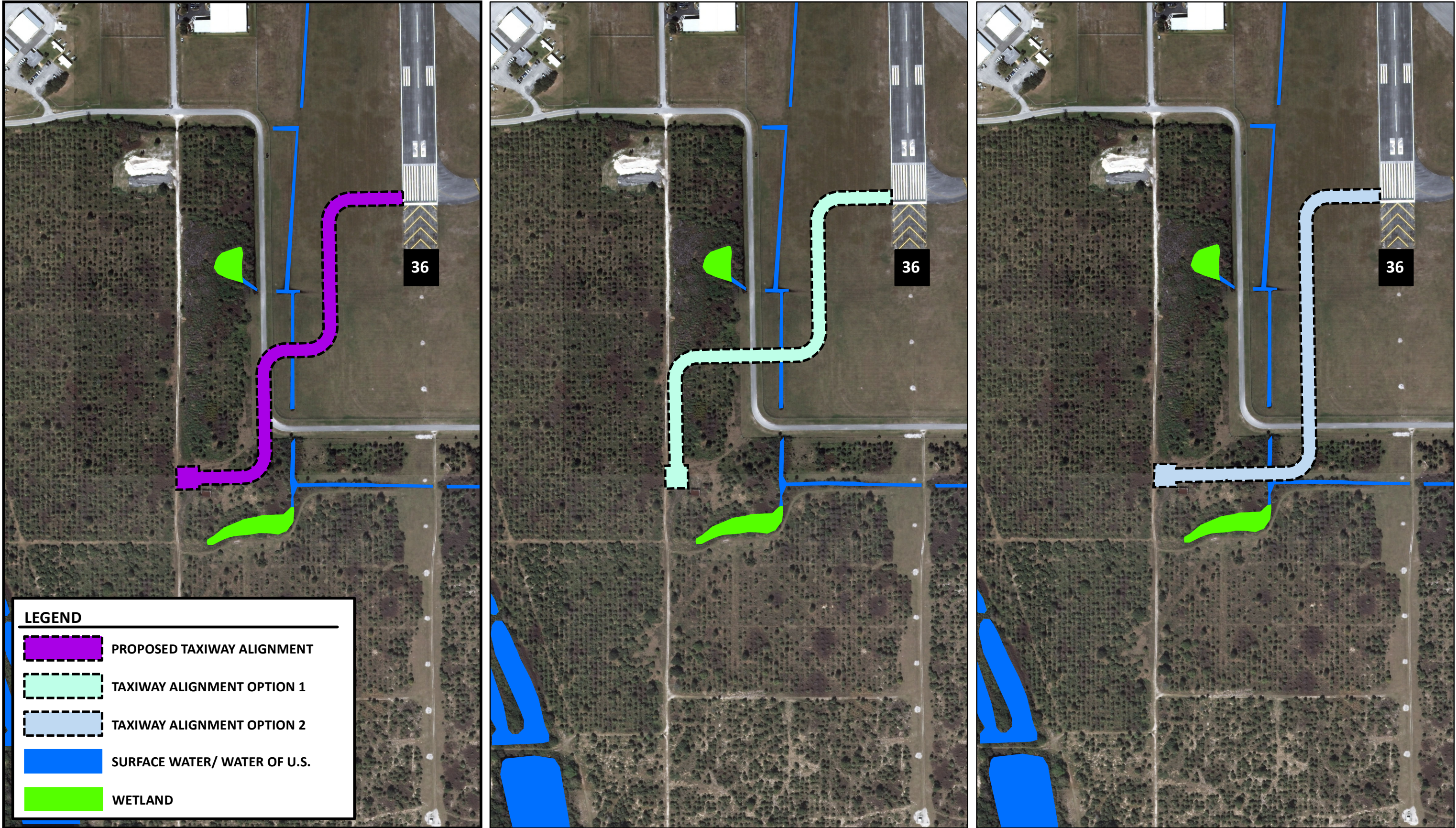
2.2.3.1 Taxiway Option 1

Taxiway Option 1 would be approximately 1,975 feet long and would have similar wetland and surface water impacts as the proposed taxiway alignment. However, the greater length of Option 1 would create more impervious surface and therefore be more expensive to construct and would require more stormwater treatment than the proposed taxiway alignment. Because this is a slight modification of the preferred taxiway alignment with similar turns, the added length, increased impervious surface, and additional costs associated with construction and stormwater treatment regulatory requirements make it a less-practicable option. Therefore, this alternative was not assessed further in the EA.

2.2.3.2 Taxiway Option 2

Taxiway Option 2 would be approximately 2,020 feet long and have the greatest amount of impervious surface of all three alternative taxiway alignments. The additional pavement would also make this the most costly option to construct. This alignment also has the greatest potential for impacts to surface waters subject to the jurisdiction and permitting authority of state and federal resource agencies. Although not shown in **Figure 2-3**, a Taxiway Safety Area would surround the taxiway and would include a graded area that is prepared or suitable for reducing the risk of damage to an aircraft deviating from the taxiway. The Taxiway Safety Area would impact much of the surface water area shown parallel to the taxiway under Option 2. The taxiway would also cross through the Precision Obstacle Free Zone, Runway Protection Zone, and Runway Object Free Area beyond the southern end of Runway 18-36 (Runway 36 end). Therefore, Option 2 was considered a less-practicable option due to the added length and impervious surface, costs, surface water impacts, and potential conflicts with airport operations. Therefore, this alternative was not assessed further in the EA.

Figure 2-3 Taxiway Alignments Considered for Proposed Project



CHAPTER 3

AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter discusses the existing human environment to establish the baseline condition for which the potential impacts of the Proposed Action and No Action Alternative are determined. During the scoping process for this EA, state and federal resource agencies, as well as federally recognized Native American tribes and sovereign nations, were sent letters requesting information about environmental resources within the TIX property limits (see **Appendix B**). Information provided by these entities was used to supplement review of other available environmental data, previous studies at TIX, and field surveys conducted for this EA. The environmental impact categories evaluated in this EA include the following:

- Air Quality
- Biological Resources (including fish, wildlife, and plants)
- Climate
- Coastal Resources
- Department of Transportation Act, Section 4(f)
- Farmlands
- Hazardous Materials, Solid Waste, and Pollution Prevention
- Historical, Architectural, Archeological, and Cultural Resources
- Land Use
- Natural Resources and Energy Supply
- Noise and Noise-Compatible Land Use
- Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks
- Visual Effects (including light emissions)
- Water Resources (including wetlands, floodplains, surface waters, groundwater, and wild and scenic rivers)

The region of influence (ROI) for each of the environmental impact categories is the spatial extent over which that environmental impact category may be affected by the Proposed Action. The ROI

is defined for each environmental impact category analyzed in the EA, and figures depicting the ROIs are provided, as applicable.

Two general ROIs are defined for purposes of analysis: construction ROI and operational ROI (see **Figure 3-1**). The construction ROI is defined as the area where construction would occur and is smaller than the TIX property boundary (see **Figure 3-2**). The operational ROI includes the flight paths of the proposed RLVs and the modeled sonic boom footprints resulting from RLV launches (see **Figure 3-3**). Each of the RLVs would depart from the north end of Runway 18-36 and then transition to a northeastern flight path over John F. Kennedy Space Center/Merritt Island National Wildlife Refuge. For purposes of this analysis it is assumed that during the portion of each RLV's flight that is over land, the RLV would be travelling at a subsonic speed. The RLVs would not reach Mach 1 (the speed of sound) until east of the Atlantic coastline, and due to the upward pointing trajectory of each spacecraft, the ascent sonic boom would not likely be perceived at sea level. The descent sonic boom for each spacecraft would occur over the open ocean and would be perceived at sea level but would be unlikely to be perceived on land. The noise analysis is presented in Section 4.12 of this EA. These descent sonic boom footprints, which represent the limits of the areas within which sonic booms would be perceived, were included in the operational ROI. The flight paths and the sonic boom footprints were buffered for a conservative consideration of potential impacts to account for minor deviations in the flight paths or modeled sonic boom footprints. The buffer expands to a maximum width of two miles at a distance approximately 20 miles east-northeast of TIX along the approach and departure flight paths. This maximum buffer width is applied to the remainder of the departure and approach flight paths east of this point and is also applied to the sonic boom footprints in an effort to avoid under-estimating the extent of the operational ROI.

The Proposed Action would not result in visual effects or impact wild and scenic rivers for the reasons explained below.

Visual Effects: The proposed construction would occur on existing airport property. The visual character of this construction would be in keeping with other existing development at TIX and would be visually obscured from adjacent off-airport properties by existing TIX facilities and/or forested areas on TIX property that provide a buffer between TIX and the adjacent properties. The area where construction would occur is not visible from any areas that would be considered sensitive to visual impacts, such as public parks or conservation areas, historical sites or buildings, residential areas, or areas that are valued for their scenic character. Although additional lighting would be installed, this would be limited to taxiway lighting, downward facing parking lot mast lighting, and downward facing flood lighting on buildings. The areas where additional lighting would be installed are not within view of any sensitive land use types. In addition, lighting from

Figure 3-1 Operational ROI

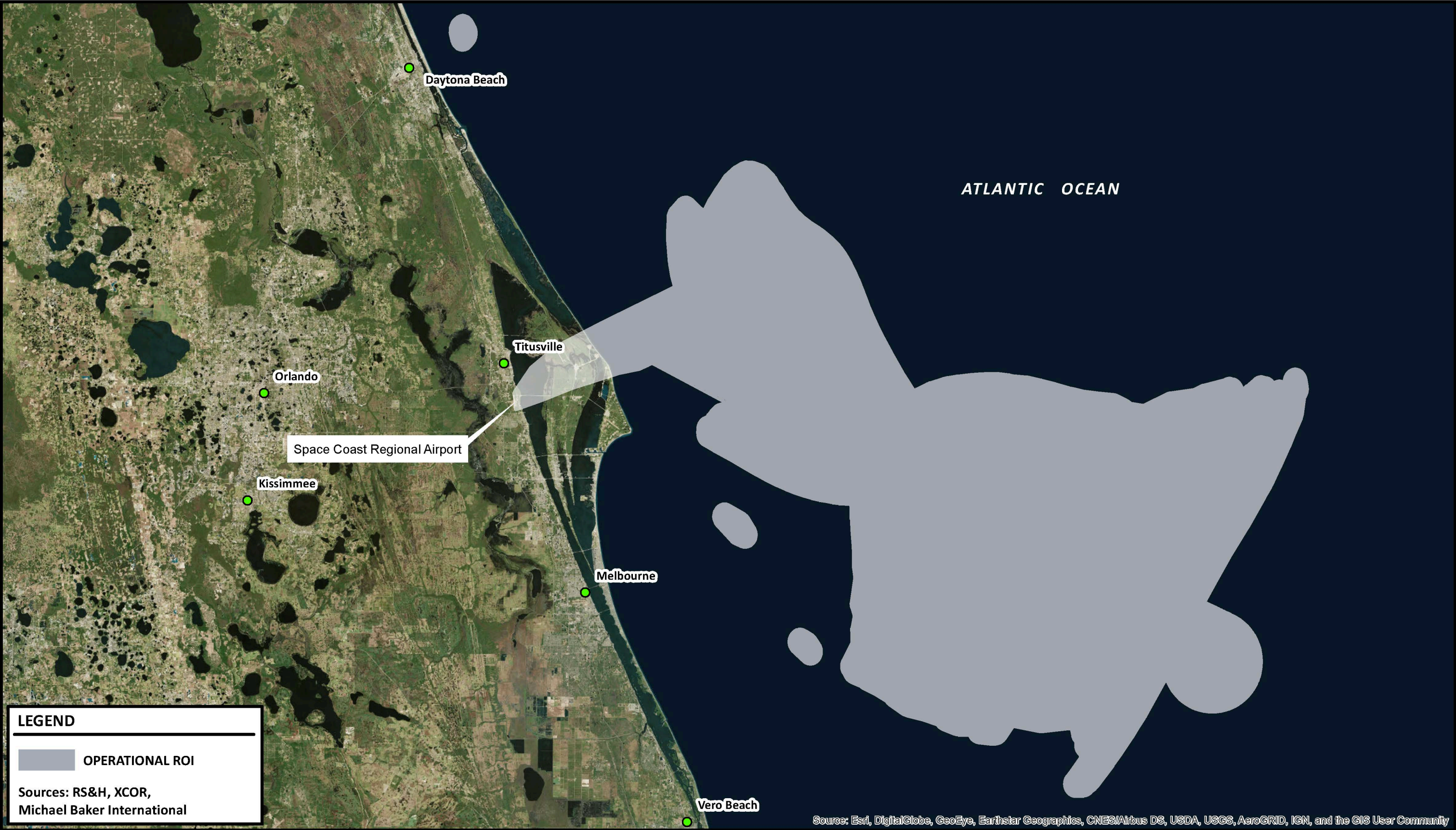


Figure 3-2 Construction ROI

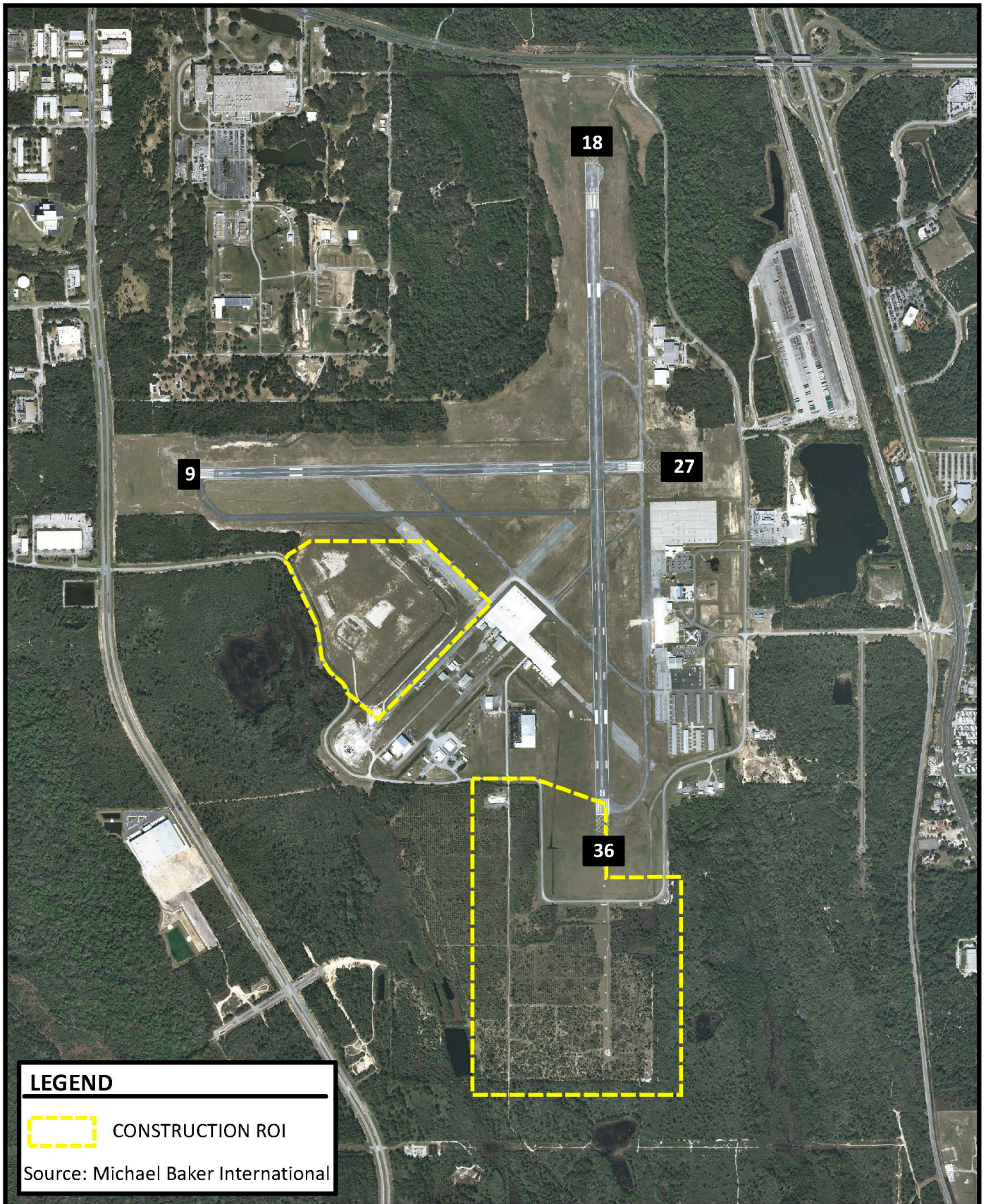
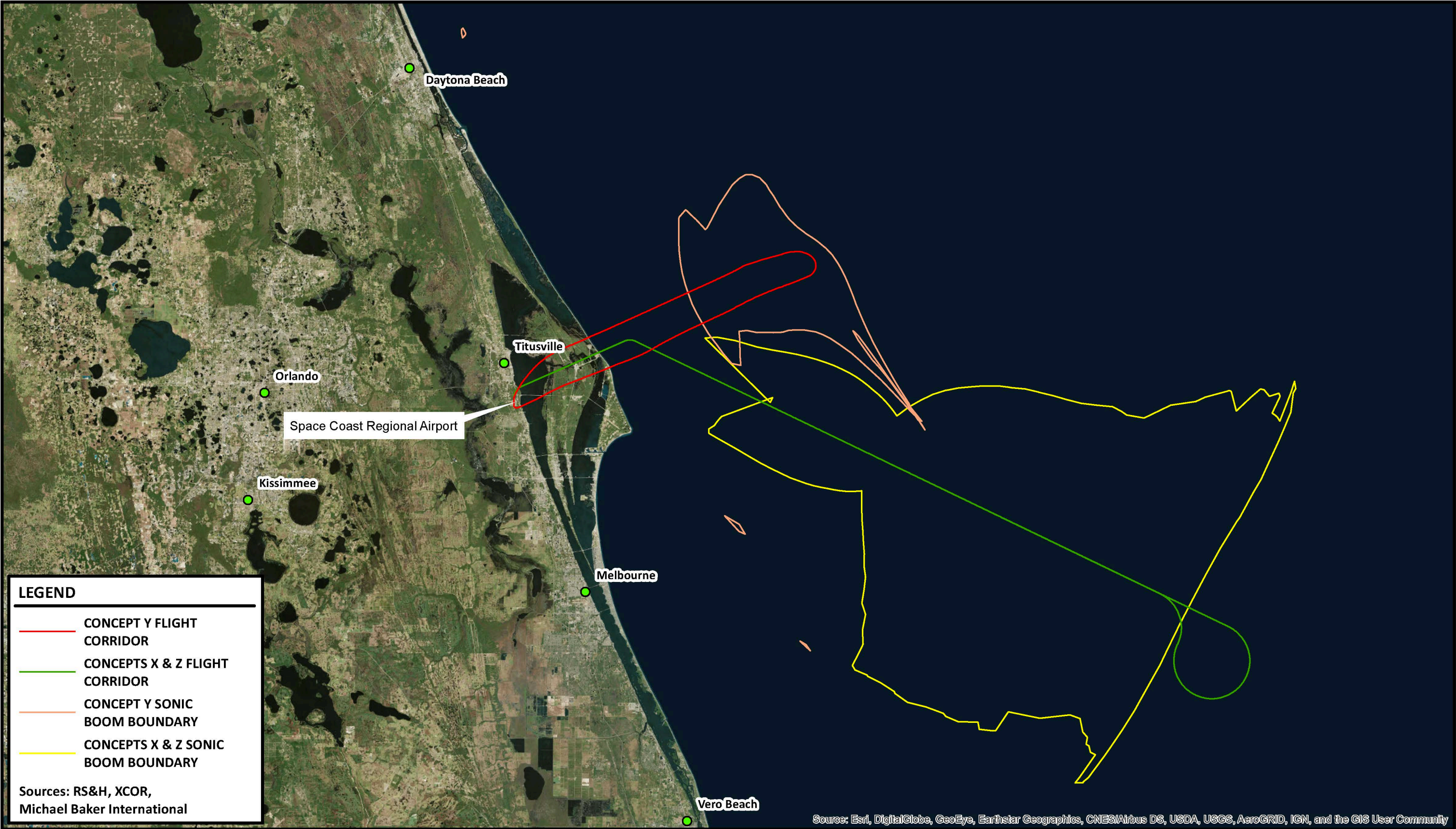


Figure 3-3 RLV Flight Paths and Modeled Sonic Boom Footprints



the spacecraft themselves would be the same type of lighting as what is used by aircraft that already operate at TIX. Most of the proposed launches would occur during daylight hours when aircraft/spacecraft lighting would not be an impact. Approximately three launches per year would occur at night. As such, light emissions effects from the RLVs themselves would be negligible. In summary, there would be no potential for adverse impacts due to visual effects and light emissions, and no further analysis of this resource category is necessary.

Wild and Scenic Rivers: The National Wild and Scenic Rivers Act (16 U.S.C. §§1271-1287) provides federal protection to rivers that are listed as significant resources for their wild, scenic, or recreational values, along with those that are under consideration for inclusion on the list. The nearest designated wild and scenic river is a segment of the Wekiva River located over 45 miles from the project. The nearest eligible river segment is the St. Johns River, which is over 4 miles west of the construction ROI. The Proposed Action would have no potential to impact these resources. Therefore, wild and scenic rivers are dismissed from detailed analysis.

The affected environment for the remaining impact categories is discussed in detail in the following sections.

3.2 AIR QUALITY

3.2.1 Background

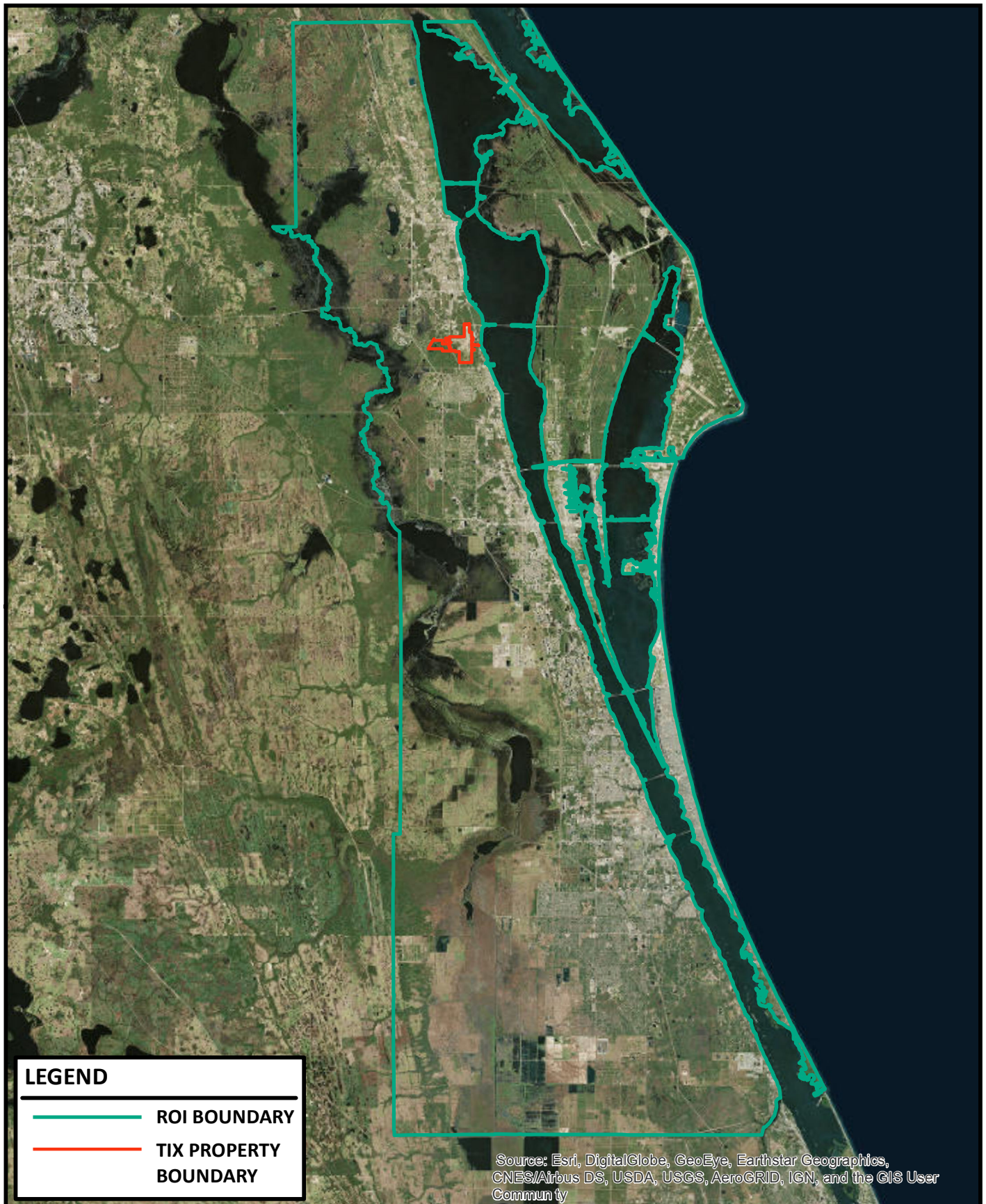
The ROI for this environmental impact category is the Brevard County jurisdictional boundary (see **Figure 3-4**).

3.2.1.1 Atmospheric Layers

The Earth's atmosphere consists of five layers (i.e., troposphere, stratosphere, mesosphere, thermosphere, and exosphere) that are separated by narrow transition zones. Each layer is characterized by altitude, temperature, structure, density, composition, and degree of ionization (i.e., the positive or negative electric charge associated with each layer).

Troposphere - This is the layer of the atmosphere closest to the Earth's surface, extending up to about 6-9 miles above the Earth's surface. It contains 75% of the atmosphere's mass. The troposphere is wider at the equator than at the poles. Temperature and pressure drops as the altitude increases in the troposphere.

Figure 3-4 Brevard County Jurisdictional Boundary ROI



Michael Baker
INTERNATIONAL

TIX Spaceport Licensing
Environmental Assessment

**BREVARD COUNTY JURISDICTIONAL
BOUNDARY ROI**

0 8
Miles



3-4

Figure No.

Stratosphere - This layer lies directly above the troposphere and is about 22 miles in depth. It extends from about 9 to 31 miles above the Earth's surface. The stratosphere is warmer at the top than the bottom. The lower portion has a nearly constant temperature with height, but in the upper portion the temperature increases with altitude because of absorption of sunlight by ozone (O₃).

Mesosphere - Directly above the stratosphere, extending from 31 to 50 miles above the Earth's surface, the mesosphere is a cold layer where the temperature generally decreases with increasing altitude.

Thermosphere - The thermosphere extends from 50 miles above the Earth's surface. The temperature is hot and may be as high as thousands of degrees as the few molecules that are present in the thermosphere receive extraordinarily large amounts of energy from the Sun.

Exosphere – This is the upper layer of our atmosphere, where atoms and molecules escape into space.

3.2.1.2 Ambient Air Quality

The U.S. Environmental Protection Agency (USEPA) sets National Ambient Air Quality Standards (NAAQS) in order to protect the public health and environmental welfare. The USEPA has identified the following six criteria air pollutant (CAPs) for which NAAQS are applicable: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO₂), O₃, particulate matter (PM₁₀ and PM_{2.5}), and sulfur dioxide (SO₂). USEPA calls these pollutants "criteria" air pollutants because it sets standards for based on criteria derived from characterizations of scientific information regarding their effects of health or welfare.¹ **Table 3.1** lists the primary and secondary NAAQS. Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.²

NAAQS are expressed in terms of pollutant concentrations. If concentrations of one or more of the six criteria pollutants in a geographic area exceeds the respective NAAQS, the USEPA classifies the area as a "nonattainment" area.

¹ USEPA, Criteria Air Pollutants, <https://www.epa.gov/criteria-air-pollutants#self>, March 8, 2018 (March 4, 2019).

² USEPA, National Ambient Air Quality Standards, <https://www.epa.gov/criteria-air-pollutants/naaqs-table>, (March 4, 2019).

Table 3.1 Federal Air Quality Standards		
Air Pollutant	NAAQS Primary Standard	NAAQS Secondary Standard
Carbon Monoxide (CO)		
1-hour average	35 ppm	None
8-hour average	9 ppm	None
Lead (Pb)		
Running 3-month average	0.15 µg/m ³	Same as primary
Nitrogen Dioxide (NO₂)		
1-hour average	100 ppb	None
Annual average	53 ppb	Same as primary
Ozone (O₃)		
8-hour rolling average	0.070 ppm	Same as primary
Particulate Matter 10 (PM₁₀)		
24-hour block average	150 µg/m ³	Same as primary
Particulate Matter 2.5 (PM_{2.5})		
24-hour block average	35 µg/m ³	Same as primary
Annual Average	12 µg/m ³	15 µg/m ³
Sulfur Dioxide (SO₂)		
1-hour average	75 ppb	None
Sulfur Dioxide (SO₂)		
3-hour block average	None	0.5 ppm
24-hour block average	None	None
Annual Average	None	None
SOURCES: USEPA, NAAQS. 40 CFR 50. October 2015 NOTES: ppb = parts per billion by volume ppm = parts per million by volume µg/m ³ = micrograms per cubic meter of air		

Nonattainment designations are generally based on the degree of nonattainment (e.g., serious, severe, moderate, marginal) which dictates the deadline (i.e., the attainment year) by which the area must be brought back into attainment of a NAAQS. States with nonattainment areas must develop a State Implementation Plan demonstrating how the area will be brought back into attainment of the NAAQS within designated timeframes. USEPA classifies an area as an “attainment” area when concentrations of all of the criteria pollutants are below the NAAQS. Lastly, areas with prior nonattainment status that have since transitioned to attainment are known as maintenance areas.

CO, a colorless and odorless gas, is a result of the combustion process. CO can be generated naturally and from anthropogenic (man-made) sources. Exposure to CO can reduce the oxygen-carrying capacity of the blood and cause harmful health effects by

reducing oxygen delivery to the body's organs (like the heart and brain) and tissues. Nationally, the majority of CO emissions are created from mobile sources.³ Vehicle emission rates of CO are the highest during low ambient temperatures.

Pb is a metal found naturally in the environment, which used in manufactured products. Historically, fuels in motor vehicles (e.g., cars and trucks) and industrial sources contributed the majority of Pb emissions. However, the Pb emissions from motor vehicles have greatly declined due to the removal of Pb from on-road motor vehicle gasoline. Today, the major sources of Pb are smelters and aircraft operating on leaded aviation gasoline.⁴ Ambient Pb concentrations also have declined greatly as Pb emissions have been reduced and are expected to be extremely low in the ROI. For this reason, Pb is not further assessed within this EA.

NO₂ is part of the “oxides of nitrogen” or “nitrogen oxides (NO_x)” group. NO₂ is the oxide of greatest concern for health effects, and USEPA uses NO₂ levels as an indicator for the other gases in this group. NO₂ emissions are typically from motor vehicles (including off-road equipment) and power plants.⁵

O₃ occurs at the ground level and in the upper regions of Earth’s atmosphere. O₃ is created by chemical reactions between NO_x and volatile organic compounds.⁶ Volatile organic compounds are released during industrial processes and when gasoline and solvents evaporate.

PM is a mixture of extremely small particles and liquid droplets of widely varied chemical composition. The NAAQS define PM in terms of particulate size, specifically those particulates smaller than 10 micrometers in diameter.⁷ USEPA has established NAAQS for particles 10 microns in diameter and smaller (PM₁₀) and 2.5 microns in diameter and smaller (PM_{2.5}). Anthropogenic sources of PM include waste disposal, fuel combustion, and processing metals.

SO₂ is part of the “oxides of sulfur” group. SO₂ emissions occur as part of natural processes, such as volcanic activity, and from anthropogenic sources including the

³ USEPA, Carbon Monoxide Pollution in Outdoor Air, <https://www.epa.gov/co-pollution>, November 5, 2018 (March 4, 2019).

⁴ USEPA, Basic Information about Lead Air Pollution, <https://www.epa.gov/lead-air-pollution/basic-information-about-lead-air-pollution#how>, November 29, 2017 (March 4, 2019).

⁵ USEPA, Nitrogen Dioxide Pollution, <https://www.epa.gov/no2-pollution>, November 5, 2018 (March 10, 2019).

⁶ USEPA, Ground-level Ozone Pollution, <https://www.epa.gov/ground-level-ozone-pollution/ground-level-ozone-basics#formation>, October 31, 2018 (March 4, 2019).

⁷ USEPA, Particulate Matter Pollution, <https://www.epa.gov/pm-pollution/particulate-matter-pm-basics#PM>, November 14, 2018 (March 4, 2019).

combustion of fossil fuels, extraction of metal for ore, burning of high sulfur fuels in locomotives, ships, and heavy equipment.⁸

The Florida Administrative Code includes rules established by the FDEP for the control of air pollutant emissions in the state. FDEP has developed, and updates as necessary, a State Implementation Plan for attaining and maintaining compliance with NAAQS. Chapter 62-404 of the Florida Administrative Code outlines the general provisions for air pollution control in the state. Florida adopted the USEPA's NAAQS and repealed the Florida Ambient Air Quality Standards in 2012.

The analysis within this EA includes emissions for operations below the "mixing layer." The top of the mixing layer is assumed to occur at nominally 3,000 feet above ground level. Emissions that occur below this altitude can mix to ground level by diffusion and wind transport, thereby affecting ground level ambient air quality. Emissions that occur above this altitude are not mixed to ground level and do not contribute to pollutant concentrations at ground level; however, greenhouse gases (GHG) are emitted and contribute to pollutant concentrations at all altitudes.

3.2.1.3 Hazardous Air Pollutants (HAPs)

According to the USEPA, hazardous air pollutants (HAPs) are those pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects. The USEPA is required under the Clean Air Act to control 187 HAPs. HAPs (e.g., benzene, which is found in gasoline)⁹ are pollutants that do not have established NAAQS and are described for NEPA disclosure purposes only.

3.2.2 Affected Environment

TIX is located in Brevard County. According to the USEPA Green Book, Brevard County is in attainment for all six criteria pollutants.¹⁰ The FDEP measures ambient air pollutant levels throughout Florida. There are seven monitoring stations for measuring O₃, PM_{2.5}, PM₁₀, and SO₂ in Brevard County. There are no monitoring stations for CO, Pb, or NO₂ in Brevard County. The closest monitoring stations for CO and NO₂ are in Orange County, immediately adjacent (west) to Brevard County. Hillsborough County, 118 miles west of Brevard County and along the Gulf of Mexico, has the only four monitoring stations for

⁸ USEPA, Sulfur Dioxide Pollution, <https://www.epa.gov/so2-pollution/sulfur-dioxide-basics#what%20is%20so2>, June 28, 2018 (March 4, 2019).

⁹ USEPA, Hazardous Air Pollutants, <http://www.epa.gov/ttn/atw/pollsour.html>, September 26, 2018 (March 4, 2019).

¹⁰ USEPA, Green Book, Current Nonattainment Counties for All Criteria Pollutants, July 31, 2013, <https://www3.epa.gov/airquality/greenbook/ancl.html#FL>, February 28, 2019, (March 4, 2019).

Pb in Florida. The Pb measurements are not included in this EA given the distance of the monitoring sites from the study area. **Table 3.2** summarizes measured levels of criteria pollutants for 2017 which is the most recent year for which complete data are available.¹¹

Table 3.2 Measured Ambient Levels of Criteria Pollutants (2017)						
Site Number	County	Scale	Criteria Pollutant			
	Address					
			Carbon Monoxide Concentrations (ppm)			
			Highest 1-Hr.	2 nd Highest 1-Hr.	Highest 8-Hr.	2 nd Highest 8-Hr.
12-095-2002	Orange	Neighborhood	2.4	1.9	1.8	1.8
	Morse Blvd. & Denning, Winter Park					
			Nitrogen Dioxide Concentrations (ppb)			
			Highest 1-Hr.	2 nd Highest 1-Hr.	Annual Average	
12-095-2002	Orange	Neighborhood	37.1	36.8	4.08	
	Morse Blvd. & Denning, Winter Park					
			Highest Eight-Hour Ozone Concentrations (ppb)			
			1 st 1-Hr.	2 nd 1-Hr.	3 rd 1-Hr.	4 th 1-Hr.
12-009-0007	Brevard	Neighborhood	66	66	63	61
	401 Florida Ave., Melbourne					
12-009-4001	Brevard	Neighborhood	69	64	63	61
	400 S 4 th St., Cocoa Beach					
			Manual PM _{2.5} Concentrations (µg/m ³)			
			Highest 24-Hr.	2 nd Highest 24-Hr.	Annual Average	
12-009-0007	Brevard	Neighborhood	36.8	26.7	6.6	
	401 Florida Ave., Melbourne					
			Manual PM ₁₀ Concentrations (µg/m ³)			
			Highest 24-Hr.	2 nd Highest 24-Hr.	Annual Average	
12-009-0007	Brevard	Urban	53.9	50.0	14.0	
	401 Florida Ave., Melbourne					
SOURCE: FDEP, Bureau of Air Monitoring, <i>Air Quality Monitoring: Highest Readings by Year</i> , https://fldep.dep.state.fl.us/air/flags/HighReport.asp?HighestYear=2018&SiteId=120730012 , accessed September 2018						
NOTES: ppb = parts per billion ppm = parts per million µg/m ³ = micrograms per cubic meter						

¹¹ FDEP, *Air Quality Monitoring: Highest Readings by Year*, <https://fldep.dep.state.fl.us/air/flags/HighReport.asp?HighestYear=2018&SiteId=120730012>, (March 4, 2019).

3.3 BIOLOGICAL RESOURCES

3.3.1 Background

3.3.1.1 Regulatory Setting

Several statutes, regulations, executive orders, and policies must be considered when assessing potential impacts to biological resources.

The Endangered Species Act (ESA; 16 U.S.C §§ 1531-1544) protects species that are listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS). The FAA is required to consider whether its actions may affect listed species or federally designated critical habitat for listed species. If the FAA determines its action may affect a listed species or critical habitat, the FAA must consult the USFWS and/or NMFS.

The Marine Mammal Protection Act (MMPA; 16 U.S.C. § 1361 et seq.) protects all marine mammals and prohibits *take*,¹² with certain exceptions, in U.S. waters and by U.S. citizens on the high seas. The MMPA is enforced by both the USFWS and NMFS, depending on the species affected. If the Proposed Action has the potential to impact marine mammals, coordination with the USFWS and/or NMFS may be required before the action can proceed.

The Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. § 1801 et seq.) was enacted to govern the conservation and management of ocean fishing, including essential fish habitat. If the Proposed Action may adversely affect essential fish habitat, the FAA must consult NMFS. During the consultation process, NMFS will provide conservation recommendations (which may include measures to avoid, minimize, mitigate, or otherwise offset adverse effects on essential fish habitat) to the FAA.

The Bald and Golden Eagle Protection Act (16 U.S.C. § 668 et seq.) prohibits the unauthorized capture, purchase, or transportation of bald and gold eagles, their nests, and their eggs. If the Proposed Action may disturb a bald or golden eagle, a permit from the USFWS is required.

The Migratory Bird Treaty Act (16 U.S.C. § 703 et seq.) prohibits intentionally taking,¹³ selling, or conducting other activities that would harm migratory birds, their eggs, or nests, unless the USFWS authorizes such activities under a special permit. The Migratory

¹² Under the Marine Mammal Protection Act, take is defined as “to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill.”

¹³ Under the Migratory Bird Treaty Act, taking is defined as “pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting.”

Bird Treaty Act was further strengthened by Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*,¹⁴ which directs federal agencies to take action to further implement the Migratory Bird Treaty Act.

Executive Order 13112, *Invasive Species*¹⁵, directs federal agencies, to the extent practicable and subject to available resources, to prevent the introduction of invasive species and to restore native species and habitats that have been invaded. It also directs agencies not to proceed with actions that are likely to cause or promote the introduction or spread of invasive species unless the benefits of such actions clearly outweigh the potential harm, and all feasible and prudent measures to minimize risk of harm are taken.

The Florida Endangered and Threatened Species Act of 1977 provides for research and management to conserve and protect threatened and endangered species as a natural resource. Responsibility for the research and management of upland, freshwater, and marine species is given to the Florida Fish and Wildlife Conservation Commission (FWC). The FWC maintains the state list of animals designated as threatened and special concern in accordance with Rules 68A-27.003 and 68A-27.005 of the Florida Administrative Code.

The ROI for biological resources includes the construction and operational ROIs. Vegetative communities are only described for the construction ROI (**Figure 3-2**) because operations would not affect plants. Both ROIs were used to discuss existing conditions for ESA-listed animal species, critical habitat, state-protected animal species, bald eagles, and marine mammals. The construction ROI was used to discuss existing conditions for ESA-listed plant species.

3.3.1.2 Data Collection

A list of ESA-listed species known to occur or with potential to occur in Brevard County was acquired from the USFWS North Florida Ecological Services website.¹⁶ Information regarding ESA-listed species that may be present in the construction ROI and the operational ROI was also obtained from the USFWS's Information for Planning and Consultation (IPaC) online system.¹⁷ A report generated from IPaC included two ESA-listed birds (Everglades snail kite and red knot), one bird proposed for listing (eastern black rail) and one ESA-listed plant (Lewton's polygala) that were not on the USFWS North Florida Ecological Services list for Brevard County. The IPaC report also noted critical habitat located within the operational ROI and a list of migratory bird species of conservation

¹⁴ Vol. 66, *Federal Register*, page 3853, January 2001.

¹⁵ Vol. 64, *Federal Register*, page 6183, February 1999.

¹⁶ USFWS, "Federally Listed Species in Brevard County, Florida," <http://www.fws.gov/northflorida/CountyList/Brevard.htm>, February 7, 2018 (March 4, 2019).

¹⁷ USFWS, "Information for Planning and Consultation," <https://ecos.fws.gov/ipac/>, (March 4, 2019).

concern likely to occur within both ROIs. Additional information was obtained from Geographic Information System (GIS) data layers depicting the USFWS consultation areas for the Everglades snail kite, crested caracara, red-cockaded woodpecker, and Florida scrub-jay, and GIS data layers depicting loggerhead sea turtle nesting critical habitat and West Indian manatee critical habitat.¹⁸ Finally, to obtain information concerning ESA-listed species occurring in marine environments in the operational ROI, the NMFS endangered and threatened species website was accessed. In addition to the sea turtles that were shown on the USFWS species lists, NMFS reports six ESA-listed whales (which are also protected under the MMPA) and three ESA-listed fish as having ranges that coincide with the operational ROI.¹⁹ USFWS and NMFS have joint jurisdiction over sea turtles, with the USFWS having regulatory authority over sea turtles when they are on land (i.e., nesting beaches) and their terrestrial critical habitat, and NMFS having regulatory authority over sea turtles and their critical habitat in the marine environment. GIS data for marine critical habitat was obtained from the NMFS website.²⁰ The list of federally protected species for Brevard County and adjacent marine waters is provided in **Table 3.3**.

A list of state-protected species was accessed from the Florida Natural Areas Inventory (FNAI) species database for Brevard County (**Appendix C**).²¹ The FNAI identified 36 state-protected animal species (15 of these are also federally protected) and 26 state-protected plant species (three with federal protection) as occurring in Brevard County. **Table 3.4** contains the list of state-protected plant and animal species occurring in Brevard County, except for those species that are federally protected that already are listed in **Table 3.3**.

A literature search was performed to obtain descriptions of these special-status species and their habitat requirements. FNAI Biodiversity Matrix data (accessed on February 13, 2019) were also reviewed to determine locations of known sightings of ESA-listed and state-listed species.²²

¹⁸ USFWS, "Geographic Information Systems," <http://www.fws.gov/verobeach/GIS.html>, June 28, 2018 (March 4, 2019).

¹⁹ NMFS, "Species Directory," <https://www.fisheries.noaa.gov/species-directory/threatened-endangered>, (March 4, 2019).

²⁰ NMFS, "Science & Data," https://www.fisheries.noaa.gov/resources/data-and-maps?title=critical+habitat&combine=All&field_species_vocab_target_id=®ion%5B1000001121%5D=1000001121&sort_by=created, (March 5, 2019).

²¹ FNAI, "FNAI Tracking List, Brevard County," <http://www.fnai.org/bioticssearch.cfm>, January 2019 (March 4, 2019).

²² FNAI, "Biodiversity Matrix," <https://www.fnai.org/biointro.cfm> (February 13, 2019).

Table 3.3
ESA-listed Species in Brevard County and Adjacent Marine Waters

Category	Common Name	Species Scientific Name	Status
Mammals	West Indian Manatee	<i>Trichechus manatus latirostris</i>	Endangered
	Southeastern Beach Mouse	<i>Peromyscus polionotus nineiventris</i>	Threatened
	North Atlantic Right Whale	<i>Eubalaena glacialis</i>	Endangered
	Blue Whale	<i>Balaenoptera musculus</i>	Endangered
	Fin Whale	<i>Balaenoptera physalus</i>	Endangered
	Humpback Whale	<i>Megaptera novaeangliae</i>	Endangered
	Sei Whale	<i>Balaenoptera borealis</i>	Endangered
	Sperm Whale	<i>Physeter macrocephalus</i>	Endangered
Birds	Audubon's Crested Caracara	<i>Polyborus plancus audubinii</i>	Threatened
	Everglade Snail Kite	<i>Rostrhamus sociabilis plumbeus</i>	Endangered
	Florida Scrub-jay	<i>Aphelocoma coerulescens</i>	Threatened
	Piping Plover	<i>Charadrius melodus</i>	Threatened
	Wood Stork	<i>Mycteria americana</i>	Threatened
	Red Knot	<i>Calidris canutus rufa</i>	Threatened
	Red-cockaded Woodpecker	<i>Picoides borealis</i>	Endangered
	Eastern Black Rail	<i>Laterallus jamaicensis jamaicensis</i>	Prop. Threat.
Fish	Smalltooth Sawfish	<i>Pristis pectinata</i>	Endangered
	Atlantic Sturgeon	<i>Acipenser oxyrinchus oxyrinchus</i>	Endangered
	Shortnose Sturgeon	<i>Acipenser brevirostrum</i>	Endangered
	Giant Manta Ray	<i>Manta birostris</i>	Threatened
	Oceanic Whitetip Shark	<i>Carcharhinus longimanus</i>	Threatened
Reptiles	Atlantic Salt Marsh Snake	<i>Nerodia clarkii taeniata</i>	Threatened
	Eastern Indigo Snake	<i>Dymarchon corais couperi</i>	Threatened
	Green Sea Turtle	<i>Chelonia mydas</i>	Endangered
	Hawksbill Sea Turtle	<i>Eremochelys imbricata</i>	Endangered
	Leatherback Sea Turtle	<i>Dermochelys coriacea</i>	Endangered
	Kemp's ridley Sea Turtle	<i>Lepidochelys kempii</i>	Endangered
	Loggerhead Sea Turtle	<i>Caretta caretta</i>	Threatened
	Gopher Tortoise	<i>Gopherus polyphemus</i>	Candidate
Plants	Carter's Mustard	<i>Warea carteri</i>	Endangered
	Lewton's Polygala	<i>Polygala lewtonii</i>	Endangered

Notes: Prop. Threat. = Proposed to be ESA-listed as Threatened.

Sources: USFWS 2019; NMFS 2019.

Table 3.4 State Protected Species in Brevard County^a			
Category	Common Name	Scientific Name	State Status
Birds	Little blue heron	<i>Egretta caerulea</i>	Threatened
	Reddish Egret	<i>Egretta rufescens</i>	Threatened
	Florida Burrowing Owl	<i>Athene cunicularia floridana</i>	Threatened
	Tricolored Heron	<i>Egretta tricolor</i>	Threatened
	Florida Sandhill Crane	<i>Antigone canadensis pratensis</i>	Threatened
	American Oystercatcher	<i>Haematopus palliatus</i>	Threatened
	Roseate Spoonbill	<i>Platalea ajaja</i>	Threatened
	Black Skimmer	<i>Rynchops niger</i>	Threatened
	Least Tern	<i>Sternula antillarum</i>	Threatened
Reptiles	Florida Pine Snake	<i>Pituophis melanoleucus mugitus</i>	Threatened
Plants^b	Curtiss' Sandgrass	<i>Calamovilfa curtissii</i>	Threatened
	Sand Butterfly Pea	<i>Centrosema arenicola</i>	Endangered
	Sand-dune Spurge	<i>Chamaesyce cumulicola</i>	Endangered
	Large-flowered Rosemary	<i>Conradina grandiflora</i>	Threatened
	Hay Scented Fern	<i>Dennstaedtia bipinnata</i>	Endangered
	Titusville Balm	<i>Dicerandra thinicola</i>	Endangered
	Tampa Vervain	<i>Glandularia tampensis</i>	Endangered
	Atlantic Coast Florida Lantana	<i>Lantana depressa</i> var. <i>floridana</i>	Endangered
	Nodding Pinweed	<i>Lechea cernua</i>	Threatened
	Pine Pinweed	<i>Lechea divaricata</i>	Endangered
	Pygmy Pipes	<i>Monotropsis reynoldsiae</i>	Endangered
	Florida Beargrass	<i>Nolina atopocarpa</i>	Threatened
	Celestial Lily	<i>Nemastylis floridana</i>	Endangered
	Hand Fern	<i>Ophioglossum palmatum</i>	Endangered
	Giant Orchid	<i>Pteroglossaspis ecristata</i>	Threatened
	Coastal Hoary-Pea	<i>Tephrosia angustissima</i> var. <i>curtissii</i>	Endangered
Notes: ^a Excludes species listed under the Federal Endangered Species Act that are depicted on Table 3.3 SSC= Species of Special Concern ^b Only those plants for which suitable habitat occurs in the construction ROI are shown. Complete list is provided in Appendix C . Source: FNAI 2019.			

Habitat requirements for each species were compared to the habitat types mapped for the construction ROI and operational ROI. For purposes of this EA, general protected-species surveys were conducted within the limits of the construction ROI on October 29, 2013, and May 27, 2014. These consisted of pedestrian surveys by project biologists to identify the presence of ESA-listed and state-listed species. In addition, a special-purpose survey for the Florida scrub-jay was conducted from October 19 to October 24, 2015. Note, protected species surveys are required by state and federal agencies and new surveys would be conducted to secure construction permits.

3.3.2 Affected Environment

3.3.2.1 Habitat in the Construction ROI

Approximately 92.7 acres of the 231-acre construction ROI consist of previously cleared land that is part of the TIX airfield and associated landside development (**Figure 3-2**). This area is comprised of managed herbaceous cover (primarily frequently mowed turf grasses). The majority (approximately 115.2 acres) of the construction ROI south of Perimeter Road is a former citrus grove. Based on a review of aerial photography, maintenance of the grove appears to have been discontinued around 2005 to 2007. Approximately 21.3 acres of natural and successional habitat remain within the construction ROI that are distributed around the periphery of the former citrus grove. There are three small (0.3 to 0.7 acre) wetlands within the former citrus grove. These wetland habitats are discussed in **Section 3.14** and identified in **Figure 3-12**.

In Florida, land use and vegetative cover are frequently described using the Florida Land Use, Cover, and Forms Classification System (FLUCS) that was developed by the Florida Department of Transportation (FDOT) and is widely accepted and used by various state and local agencies.²³ The following descriptions of upland community types within the construction ROI are based on review of the 2014 St. Johns River Water Management District (SJRWMD) FLUCS mapping (**Figure 3-5**), available aerial photography, and confirmation of habitat descriptions based on observations made during the species surveys conducted for the EA. The upland community types within the construction ROI at TIX are listed in **Table 3.5** and described below.

The most prevalent land cover type in the construction ROI is “abandoned citrus groves.” This area is confined to the portion of the construction ROI south of Perimeter Road and, according to the FLUCS mapping, occupies approximately 113.7 acres of the construction ROI. Because this former citrus grove was acquired by TIX and is no longer maintained, vegetative succession is gradually turning this area into an upland-disturbed shrub habitat. Most of the citrus trees are either already dead or appear to be dying. In addition to the remnant citrus trees, species such as muscadine grape (*Vitus rotundifolia*), dog fennel (*Eupatorium capillifolium*), Brazilian pepper (*Schinus terebinthifolius*), and many others are encroaching on this area.

²³ FDOT, *Florida Land Use, Cover and Forms Classification System*, January 1999.

Figure 3-5 Land Cover Types in Construction ROI

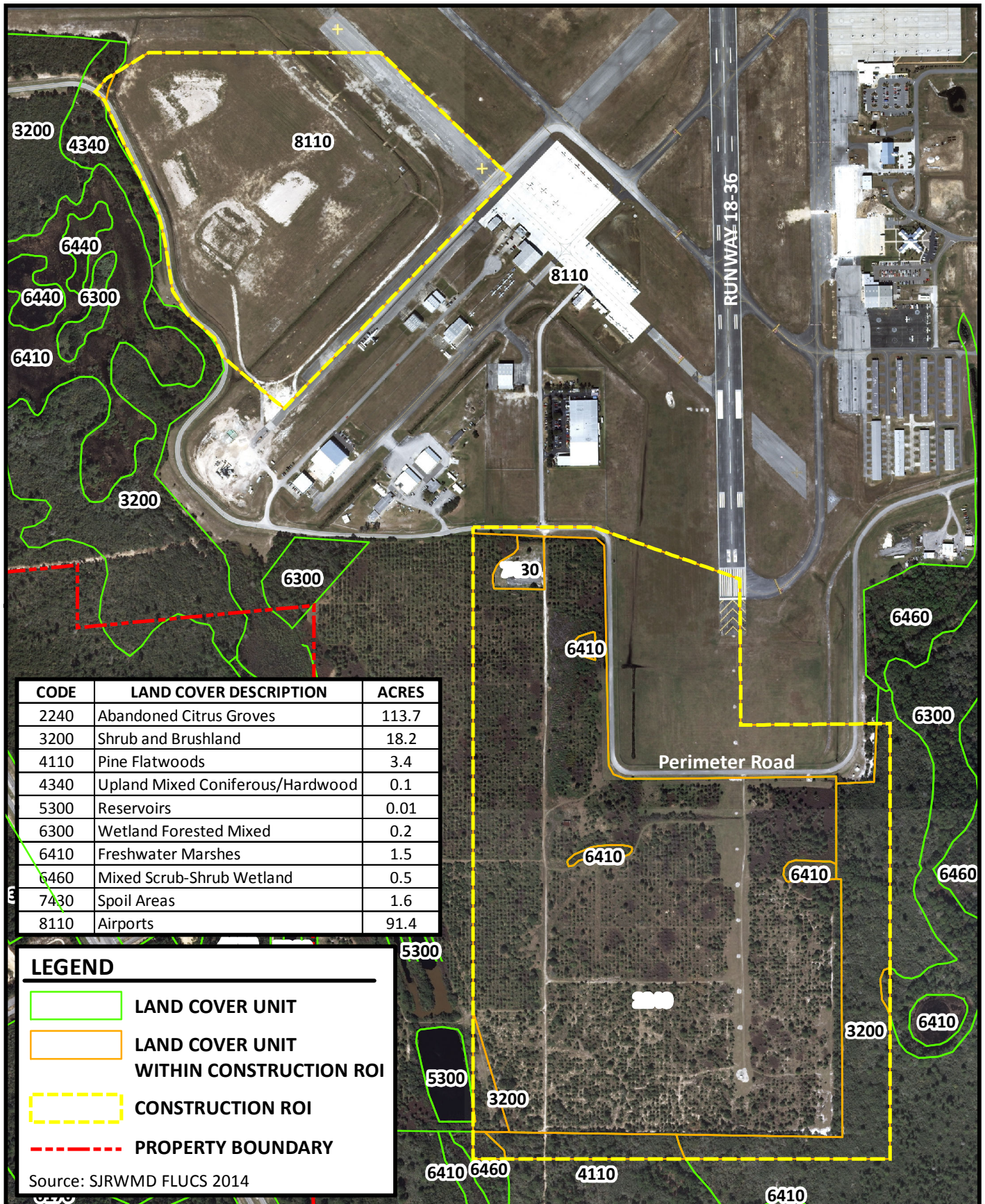


Table 3.5 Upland Habitats within the Construction ROI		
FLUCS Code	Landcover Description	Acres (approx.)
2240	Abandoned citrus groves	113.7
3200	Shrub and brushland	18.2
4110	Pine flatwoods	3.4
4340	Upland mixed coniferous/hardwood	0.1
7430	Spoil areas	1.6
8110	Airports	91.4
Sources: SJRWMD 2014, Michael Baker International 2014		

The second most extensive land cover type in the construction ROI is “airports” which occupies approximately 91.4 acres of the ROI. In this land cover type, the dominant vegetation consists of bahiagrass (*Paspalum notatum*). Other common turfgrass weeds and grasses are interspersed with the bahiagrass. This land cover type is maintained by regular mowing.

Approximately 18.2 acres of the construction ROI is “shrub and brushland” that is located on the east side of the portion of the construction ROI, south of Perimeter Road. Vegetation typically includes species such as saw palmetto (*Serenoa repens*), wax myrtle (*Myrica cerifera*), fetterbush (*Lyonia* spp.), muscadine grape, gallberry (*Ilex glabra*), wiregrass (*Aristida stricta*), bracken fern (*Pteridium aquilinum*) and scattered cabbage palms (*Sabal palmetto*). Sand live oak (*Quercus geminata*) and slash pine (*Pinus elliottii*) are also components of the overstory in this area.

The remaining upland land cover types shown within the construction ROI include “pine flatwoods,” “upland mixed coniferous/hardwood,” and “spoil areas.” The pine flatwood area is located along the southwest border of the construction ROI and has an overstory primarily of slash pine with interspersed laurel oak (*Quercus laurifolia*), live oak (*Quercus virginiana*), saw palmetto, and cabbage palms. The upland mixed coniferous/hardwood area is a small portion of a forested area that is overlapped by the northwest corner of the construction ROI and is dominated by slash pine, live oak, and saw palmetto. The spoil areas cover type is mapped approximately 900 feet west of the approach end of Runway 36, just south of perimeter road. This is a small area where soil has been stockpiled by TIX.

3.3.2.2 Wildlife

Wildlife observations were previously documented at TIX by an FAA-qualified wildlife biologist contracted by TCAA to perform a Wildlife Hazard Assessment (WHA) that was started in 2011 and finalized in 2012.²⁴ The WHA spanned 12 months. Based on the wildlife observations, assumptions can be made about species of wildlife or animal groups that may be present in the construction ROI and the larger operational ROI.

Large and medium sized mammals such as white-tailed deer, feral hogs, and coyotes were documented using the habitats around TIX, outside the perimeter fence, such as the portion of the construction ROI south of Perimeter Road. The perimeter fence predominantly surrounds the mowed and maintained airfield, but also includes some smaller wooded areas on the east and west sides of Runway 18 and on the north and south sides of Runway 9. At the time the surveys for the WHA were performed, the perimeter fence had just been completely closed around the airfield in order to decrease hazards for aircraft operations. Deer, coyotes, and hogs were observed within the perimeter fence at the beginning of the assessment, but management efforts appeared to have removed all feral hogs and most deer from the area within the fence by the end of the assessment. It is likely that most, if not all, large mammals have now been excluded from the portion of the construction ROI that is within the airfield's perimeter fence. Coyotes were still observed occasionally within the fence by the end of the WHA surveys and are likely to still use habitats in portions of the construction ROI that are within the perimeter fence. Other various small mammals, birds, reptiles, and amphibians were observed using habitats both within and outside the airfield's perimeter fence. All of these species would also be anticipated to be within the portion of the operational ROI that is over dry land.

A complete list of wildlife species observed, or for which evidence of their occurrence was observed during the WHA, is provided in **Appendix D**. The WHA documented 30 species of birds, eight species of reptiles, two species of amphibians, and six species of mammals over the course of the surveys for the WHA. Special-status species observed on TIX property during the surveys for the WHA included bald eagles, which were occasionally seen in flight around TIX's property; gopher tortoises, which occupy habitat both within and outside the airfield perimeter fence; sandhill cranes, which were frequently seen foraging on the airfield; and American kestrels, which were also observed foraging on the airfield. The WHA also listed the eastern indigo snake as a species suspected of being on TIX property. No details were provided, but this conclusion may have been reached based

²⁴ Exner, Gary, "Space Coast Regional Airport (KTIX) Wildlife Hazard Assessment," December 20, 2012.

on the presence of gopher tortoise burrows on TIX property, which increases the likelihood of occurrence of indigo snakes.

Additional wildlife observations were recorded during the general protected species survey conducted for this EA on October 29, 2013, and on May 27, 2014, as well as during the Florida scrub-jay survey conducted for this EA from October 19 to October 24, 2015. Eight species of birds were observed during these surveys. These species were all also previously documented by the WHA. The surveys confirmed the presence of the gopher tortoise and the American kestrel within the portion of the construction ROI south of Perimeter Road. Due to the time of the year the kestrel observation was made, it was not possible to determine whether it was a southeastern American kestrel, which is a species of special concern, or a northern migrant, which does not have species of concern status.

In addition to these terrestrial species, the operational ROI contains habitat for estuarine and marine species that are too numerous to list. This includes portions of the ROI where sonic boom footprints overlap the Atlantic Ocean.

3.3.2.3 ESA-Listed Species

West Indian Manatee

The West Indian manatee uses marine, estuarine, and freshwater habitats throughout Florida and the Caribbean.²⁵ They prefer large, slow-moving rivers and shallow coastal areas, such as lagoons and bays.²⁶ Manatees are generalist herbivores that forage on all types of aquatic vegetation, including terrestrial plants overhanging waters and several species of algae.²⁷ All waters within and between the Indian and Banana Rivers of Brevard County were designated as critical habitat for the Florida manatee in 1977.²⁸ The portion of the operational ROI that represents the RLV flight paths over Indian River and Merritt Island extends over manatee critical habitat, but the construction ROI does not overlap manatee habitat. The portion of the operational ROI comprised of the sonic boom footprints does not overlap suitable manatee habitat.

²⁵ USFWS, "Species Profile: West Indian manatee (*Trichechus manatus*)," <https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=A007> (March 10, 2019).

²⁶ USFWS, *West Indian manatee, Trichechus manatus*, February 2008, <http://www.fws.gov/endangered/esa-library/pdf/manatee.pdf>, February 2008 (March 10, 2019).

²⁷ Kenneth N. Smith, FDEP, *Manatee Habitat and Human-related Threats to Seagrass in Florida: A Review*, October 1993.

²⁸ Vol. 42, *Federal Register*, page 47840, September 1977.

Southeastern Beach Mouse

The southeastern beach mouse is an endangered subspecies of the old field mouse that occurs within sea oat habitat in coastal primary dunes and likely also uses adjacent coastal strand habitat to a lesser extent.²⁹ The subsonic portion of the operational ROI, where the RLV flight paths cross the Kennedy Space Center/Merritt Island National Wildlife Refuge Atlantic shoreline, includes suitable habitat for this species. The construction ROI and the portion of the operational ROI comprised of the sonic boom footprints do not overlap suitable southeastern beach mouse habitat.

Whales

Six endangered whale species could use waters within the operational ROI. Most of these whale species (blue whale, fin whale, humpback whale, sei whale, and sperm whale) would primarily use waters at or beyond the continental shelf that are in excess of 328 feet deep. Generally speaking, waters of this depth occur more than 30 miles east of the Atlantic shoreline. One whale species, the North Atlantic right whale, uses waters in closer proximity to the shoreline within the operational ROI. Critical habitat for this species occurs in a zone from the shoreline to approximately six miles seaward and parallels the coast through the operational ROI.

Audubon's Crested Caracara

Audubon's crested caracara is a bird species that typically inhabits dry and wet prairie, pasture and rangeland, associated wetlands, and sparsely wooded areas with partial coverage of saw palmetto. The grassed uplands portion of the construction ROI north of Perimeter Road provide poor habitat for this species, because the airfield is mowed frequently and there is little forage for caracaras in the relatively sterile environment of the airfield. The perimeter fence excludes most medium and large sized mammals from the airfield, so the probability of the occurrence of larger carrion (food) items on the airfield is low. The land cover in the portion of the construction ROI south of Perimeter Road predominantly consists of a large area of dead and dying citrus trees and volunteer shrubs within the abandoned citrus grove. This area is surrounded primarily by wooded habitat types that do not provide well-suited habitat for caracaras. No caracaras were observed during the WHA surveys or during the field surveys conducted for this EA, and this is a conspicuous species that would have been observed if it were using habitat on TIX property.³⁰ The construction ROI and the portion of the operational ROI that is west of the Indian River overlap the caracara consultation area, but according to a February 2019 review of the FNAI Biodiversity Matrix there are no current or historical records of

²⁹ USFWS, *Anastasia Island Beach Mouse and Southeastern Beach Mouse Recovery Plan*, http://ecos.fws.gov/docs/recovery_plan/930923b.pdf, September 23, 1993 (March 10, 2019).

³⁰ Exner, Gary, "Space Coast Regional Airport (KTIX) Wildlife Hazard Assessment," December 20, 2012.

caracaras from the area overlapped by the construction ROI or the operational ROI. Based on a review of the land cover mapping, there is no well-suited habitat for this species in the portion of the operational ROI that overlaps the caracara consultation area.

Eastern Black Rail

The eastern black rail is a small pale gray to blackish-gray rail that utilizes brackish marsh, salt marsh, and freshwater marsh in Florida. Due to its small size and its habit of utilizing areas of tall marsh vegetation, it can be difficult to locate, but its presence can be detected by its distinctive vocalization. This species has been proposed for listing under the ESA. They thought to be in decline due to habitat loss and fragmentation, suppression of fire, and various other stressors.³¹ Review of the FNAI Biodiversity Matrix in February 2019 did not indicate the presence of the black rail in either the construction ROI or the operational ROI. No suitable habitat for this species occurs in the construction ROI. Areas of marsh on Merritt Island provide suitable habitat for this species.

Everglade Snail Kite

The construction ROI and the portion of the operational ROI west of the Indian River are within the USFWS consultation area for the everglade snail kite. However, there is no suitable snail kite habitat, as described in the USFWS South Florida Ecological Services Office Snail Kite Survey Protocol, within the construction ROI.³² Much of the operational ROI is outside the snail kite consultation area, which does not extend eastward across the Indian River in the vicinity of TIX.³³ Snail kites use freshwater marsh wetlands, typically with interspersed areas of open water as well as lake edges as foraging and nesting habitat. Nests are typically constructed in small trees such as willows or Brazilian pepper and in emergent aquatic vegetation such as cattails. They forage on apple snails that cling to emergent wetland vegetation.³⁴ Some ponds and freshwater marsh areas occur within the operational ROI that could be used as foraging habitat and perhaps as nesting habitat. These habitats are located in areas overlapped by the portion of the operational ROI where RLVs would be operating at subsonic speeds. Based on a February 2019 review of the FNAI Biodiversity Matrix and a review of the January 2019 FNAI tracking list for Brevard County, there are no current records of this species occurring the construction ROI, the Operational ROI, or in Brevard County as a whole. Additionally, this species was

³¹ USFWS, *Eastern Black Rail*, <https://www.fws.gov/southeast/wildlife/birds/eastern-black-rail/>, February 20, 2019 (March 7, 2019).

³² USFWS, *Snail Kite Survey Protocol*, <http://www.fws.gov/verobeach/BirdsPDFs/SnailKiteSurveyProtocol.pdf>, May 18, 2004 (March 10, 2019).

³³ USFWS, *Snail Kite Consultation Area Map*, <http://www.fws.gov/verobeach/BirdsPDFs/SnailKiteConsultationArea.pdf>, May 18, 2004 (March 10, 2019).

³⁴ USFWS, *Multi-Species Recovery Plan for South Florida*, <http://www.fws.gov/verobeach/MSRPPDFs/EvergladeSnailKite.pdf>, May 18, 1999, (March 10, 2019).

not observed during the WHA surveys at TIX or during the species surveys conducted for this EA.

Florida Scrub-jay

The Florida scrub-jay typically prefers sandy xeric scrub habitats dominated by sand live oak, Chapman oak (*Quercus chapmanii*), myrtle oak (*Quercus myrtifolia*), and scrub oak (*Quercus inopina*). Optimally, the shrub layer formed by these oaks is 3 to 10 feet high and unvegetated openings are present at a coverage ranging from 10 to 50 percent. Sand pine is often scattered through the habitat, but the canopy is predominantly open.

This species was previously documented to occur in the northwest portion of the construction ROI. However, subsequent to this documented sighting, this area was surveyed for scrub-jays in 2003 and again in 2012, and no scrub-jays were documented in the area. The habitat in the area is no longer suitable for this species due to lack of land management and growth of canopy trees. The USFWS previously concurred that clearing the area would not impact scrub-jay habitat or scrub-jays (see **Appendix E**). Following USFWS concurrence, the area was cleared and is currently being maintained (mowed) as part of the airfield. It no longer contains suitable habitat for scrub-jays.

The citrus grove in the southern portion of the construction ROI is a habitat type that, while not ideal for Florida scrub-jays, could be used by scrub-jays if they are present in the area and preferred habitat types are not available. This habitat was surveyed for scrub-jays from October 19 to October 24, 2015, following the USFWS' scrub-jay survey protocol. No scrub-jays were observed.

The operational ROI crosses scrub-jay habitat on Merritt Island within Kennedy Space Center/Merritt Island National Wildlife Refuge. This habitat is located in areas overlapped by the portion of the operational ROI where RLVs would be operating at subsonic speeds.

Piping Plover

The piping plover is a small shorebird that is a wintering migrant in Florida. It uses sandy beaches, particularly those near ends of barrier islands, on peninsulas, and near inlets. They forage on insects, crustaceans, worms, and small mollusks. Suitable habitat for this species occurs within the portion of the operational ROI that represents the subsonic portion of the RLV flight corridors. The construction ROI and the sonic boom footprints within the operational ROI do not overlap piping plover habitat.

Wood Stork

The wood stork is a large wading bird that uses freshwater and estuarine habitats.³⁵ Cypress or mangrove swamps are commonly used for nesting.³⁶ The wood stork typically forages in open, shallow wetlands including freshwater marshes; depressions in cypress heads; swamp sloughs; managed impoundments; stock ponds; shallow, seasonally-flooded roadside or agricultural ditches; and narrow tidal creeks or shallow tidal pools.³⁷ The wood stork primarily feeds on small fish in calm waters 6 to 10 inches deep.³⁸ The most active feeding areas consist of marsh depressions that flood in the spring and begin to dry up in the summer, concentrating fish in small areas.³⁹ The wood stork is highly colonial, nesting in large rookeries and often feeding in flocks.⁴⁰ There is no nesting habitat for this species within the construction ROI, and there are no documented nest colonies within the operational ROI.

The construction ROI and part of the operational ROI fall within the 15-mile core foraging area of two wood stork colonies, both located due south of the construction ROI. The nearest of these two nesting colonies is approximately 8.9 miles south of the construction ROI.⁴¹ Suitable foraging habitat is described as any area containing patches of relatively open, calm water, and having a permanent or seasonal water depth between 2 and 15 inches.⁴² Seasonally flooded wetlands and ditches in the construction ROI and operational ROI may provide suitable foraging habitat for wood storks. No wood storks were observed in the construction ROI during the WHA and the species surveys conducted for this EA, and no wood storks are documented in the construction ROI according to a February 2019 review of the FNAI Biodiversity Matrix. Wood storks are known to forage within the Merritt Island National Wildlife Refuge, which is overlapped by part of the operational ROI that represents the RLV flight paths.

³⁵ USFWS, "Species Account/Biologue: Wood Stork, *Mycteria americana*," May 21, 2015, <http://www.fws.gov/northflorida/Species-Accounts/Wood-stork-2005.htm> (March 10, 2019).

³⁶ *Ibid.*

³⁷ USACE and USFWS, *The Corps of Engineers, Jacksonville District, U.S. Fish and Wildlife Service, Jacksonville Ecological Services Field Office and State of Florida Effect Determination Key for the Wood Stork in Central and North Peninsular Florida*, September 2008, http://www.fws.gov/northflorida/WoodStorks/Documents/20080900_JAXESO_WOST_Key.pdf (March 10, 2019).

³⁸ USFWS, "Species Account/Biologue: Wood Stork, *Mycteria americana*," May 21, 2015, <http://www.fws.gov/northflorida/Species-Accounts/Wood-stork-2005.htm> (March 10, 2019).

³⁹ *Ibid.*

⁴⁰ *Ibid.*

⁴¹ USFWS GIS data, February 24, 2010.

⁴² USACE and USFWS, *The Corps of Engineers, Jacksonville District, U.S. Fish and Wildlife Service, Jacksonville Ecological Services Field Office and State of Florida Effect Determination Key for the Wood Stork in Central and North Peninsular Florida*, September 2008, http://www.fws.gov/northflorida/WoodStorks/Documents/20080900_JAXESO_WOST_Key.pdf (March 10, 2019).

Red Knot

The red knot is a medium sized shorebird that breeds in the Canadian Arctic and overwinters along the southeastern coast of the United States, Mexico, Brazil, and as far south as Tierra del Fuego. Some red knots are known to overwinter at Merritt Island/Cape Canaveral and others pass through and stopover briefly in Atlantic coastal areas during migration to areas further south. They use tidal flats of estuaries and intertidal zones of beaches, where they forage on small mollusks and other invertebrates, small fish, and plant seeds. Suitable habitat for this species is overlapped by the portion of the operational ROI that represents the subsonic portion of the RLV flight corridors. The construction ROI does not overlap suitable red knot habitat.

Red-cockaded Woodpecker

The red-cockaded woodpecker occurs throughout Florida but is distributed based on the locations of the remaining old-growth pine forests that are relatively free of hardwood undergrowth. Red-cockaded woodpeckers prefer to nest in longleaf pine trees. Though they prefer to nest and forage in mature pine forests, they will also forage in younger pine and mixed pine-hardwood stands. The area in the southern portion of the construction ROI identified as pine flatwoods (**Figure 3-5**) has a slash pine component in the overstory, but it is mixed with hardwood species, has an overgrown understory, and is not suitable habitat for red-cockaded woodpecker nesting. If the understory were burned, the area could be marginally suitable for red-cockaded woodpecker foraging habitat if a colony were nearby, but the current dense shrub undergrowth would likely deter red-cockaded woodpeckers from using the area. Based on a review of the FLUCS data, there does not appear to be suitable habitat for this species in the operational ROI. Pine forests within the operational ROI are few in number and are fragmented. Also, based on the FLUCS data, the largest areas of pine flatwoods mapped within the operational ROI are less than 30 acres in size. According to 2019 FWC red-cockaded woodpecker observation location data, the nearest known occurrences of this species are over 27 miles west of the construction ROI.⁴³ Neither the construction ROI nor the operational ROI overlap any of the USFWS' red-cockaded woodpecker consultation areas.

Smalltooth Sawfish

The smalltooth sawfish is an unusual fish closely related to rays and more distantly related to sharks. It is named for its elongated snout with lateral teeth that it uses to detect and stun prey. Based on information in the *Smalltooth Sawfish Recovery Plan*, it reaches sizes in excess of 16 feet in length and 700 pounds. Waters of the Indian River, Banana River,

⁴³ FWC, "Red-cockaded Woodpecker Observation Locations," http://geodata.myfwc.com/datasets/606024ebee054e4f89d90fa1a456292f_10, February 11, 2019 (March 5, 2019).

and Atlantic Ocean within the limits of the operational ROI are part of the historic range of the smalltooth sawfish, although it is rarely reported from these areas today.⁴⁴ In the U.S. it is most abundant in south and southwest Florida, particularly in the waters of the Everglades. There is no habitat for this species in the construction ROI.

Shortnose Sturgeon

The shortnose sturgeon is an anadromous species that spawns in freshwater riverine habitat and spends most of the remainder of its life around the saltwater/freshwater interface and in estuarine habitats. They occasionally venture into nearshore marine habitat. The St. Johns River is at the southernmost end of this species range, but spawning is thought to no longer occur in the St. Johns due to the damming of the Ocklawaha River. The historic spawning grounds of this species in the St. Johns are believed to be upstream of the dam. In recent years, the shortnose sturgeon has only been found in very low numbers in the St. Johns. Shortnose sturgeon have been documented in the Indian River Lagoon on very rare occasions.⁴⁵ The operational ROI overlaps portions of the Indian River that technically are within the historic range of this species based on these rare occurrences. There is no habitat for this species in the construction ROI.

Atlantic Sturgeon

The Atlantic sturgeon is an anadromous fish species that uses estuarine and nearshore marine habitats for much of its life, but spawns in riverine habitats. Historically, this species was abundant in the St. Johns River, but due in part to impoundment of the Ocklawaha River, an upstream tributary to the St. Johns that is thought to have contained most of the sturgeon spawning habitat in this river system, it is unlikely that Atlantic sturgeon spawn within the St. Johns currently. Atlantic sturgeon are still caught occasionally in Florida waters. These may be individuals that migrated from river systems in Georgia. The portion of the operational ROI representing the RLV flight corridors extends over nearshore marine habitat that is at least occasionally used by Atlantic sturgeon.⁴⁶ There is no habitat for this species in the construction ROI.

⁴⁴ NMFS, *Smalltooth Sawfish Recovery Plan*, https://sero.nmfs.noaa.gov/protected_resources/sawfish/documents/smalltoothsawfish_recovery_plan.pdf; January 2009 (March 10, 2019).

⁴⁵ Smithsonian Marine Station at Ft. Pierce, Species Name: *Acipenser brevirostrum*, http://www.sms.si.edu/irlspec/Acipes_brevir.htm, June 20, 2006 (March 10, 2019).

⁴⁶ "Endangered and Threatened Wildlife and Plants; Final Listing Determinations for Two Distinct Population Segments of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the Southeast," Federal Register 77 (February 6, 2012).

Giant Manta Ray

The giant manta ray is the largest of the rays, reaching a length of 23 feet and a wingspan of 29 feet. They can be completely black in color or black on the back and white on the belly. They feed on plankton and can occur anywhere from the water's surface to depths of more than 300 feet. They typically occur in oceanic waters and near productive coastlines.⁴⁷ The operational ROI, including the area within the descent sonic boom contours, contains suitable habitat for this species.

Oceanic Whitetip Shark

Oceanic whitetip sharks are large apex predators of the open ocean, outer continental shelf, and around oceanic islands, typically in waters that are greater than 600 feet in depth. They grow to lengths of more than 11 feet and are thickly built with grayish brown to bronze coloration, whitish bellies and mottled white on the tips of the dorsal pectoral and tail fins. Although they can dive to much greater depths, they typically occur near the water's surface.⁴⁸ The operational ROI, including the area within the descent sonic boom contours, contains suitable habitat for this species.

Atlantic Salt Marsh Snake

The Atlantic salt marsh snake is a small gray to olive colored snake with black stripes. It inhabits brackish tidal marshes and mangrove swamp, where it feeds on small fish, crabs, shrimp, and other invertebrates. The portion of the operational ROI representing the RLV flight corridors extends over suitable habitat for this species in the Indian River and Banana River. There is no habitat for this species in the construction ROI.

Eastern Indigo Snake

The eastern indigo snake is a large bluish-black snake that is widely distributed throughout central and southern Florida, but primarily occurs in sandhill habitats in northern Florida. It uses various types of habitats including sandhills, flatwoods, hammocks, coastal scrub, palmetto flats, wet prairies, and the edges of freshwater marshes. Indigo snakes often take refuge in the burrows of gopher tortoises or armadillos during the winter months. They have an extremely variable and large home range (up to 550 acres for males) but are more likely to inhabit areas that have a mixture of wetlands and tortoise inhabited uplands. The construction ROI contains suitable habitat for this species, including the presence of gopher tortoise burrows in the abandoned citrus grove south of Perimeter Road. The portion of the operational ROI representing the RLV flight corridors also extends over suitable habitat for this species.

⁴⁷ NMFS, *Giant Manta Ray*, <https://www.fisheries.noaa.gov/species/giant-manta-ray>, (March 5, 2019).

⁴⁸ NMFS, *Oceanic Whitetip Shark*, <https://www.fisheries.noaa.gov/species/oceanic-whitetip-shark>, (March 5, 2019).

Sea Turtles

Five sea turtles—green, leatherback, hawksbill, Kemp’s ridley, and loggerhead—have ranges that include the marine waters that are overlapped by the operational ROI. One of those species, the loggerhead, also has critical habitat within the boundary of the operational ROI that includes terrestrial shoreline habitat where loggerhead nests are excavated. The portion of the operational ROI within which these species could occur includes terrestrial and marine habitat within the subsonic areas of the flight corridors as well as marine habitat within the sonic boom footprints associated with the RLVs.

Carter's Mustard

Carter’s mustard is an upright annual herb that grows to height of 0.6 to 5 feet. It blooms in September and October. Carter’s mustard is primarily known from the Lake Wales Ridge of inland central Florida but has been documented from coastal scrub habitat in Brevard County. It inhabits scrubby flatwoods, turkey oak/hickory-dominated sandhills, xeric hammocks, coastal scrub, and slash pine dominated flatwoods with sandy soil.⁴⁹ Based on a February 2019 review of the FNAI Biodiversity Matrix, there are no recent or historic documented occurrences of this species from the area of the construction ROI. The University of Florida herbarium has a single record of this species from Brevard County in an area of coastal scrub approximately 34 miles south-southeast of TIX.⁵⁰ Pine flatwood and shrub and brushland habitat in the south portion of the construction ROI is similar to the type of habitat in which this species normally occurs, but this species is dependent on fire. Fire is excluded/suppressed on TIX property because it presents a hazard for visibility during aircraft operations.

Lewton’s Polygala

Lewton’s polygala is a flowering herb in the milkwort family. Suitable habitat for Lewton’s polygala includes oak scrub (typically dominated by turkey oak) and high pine as well as the transitional areas between these two habitat types. It is known primarily from the Lake Wales Ridge and Mount Dora Ridge in central Florida. It is a species that depends on fire to maintain suitable habitat.⁵¹ No suitable habitat for this species occurs in the construction ROI. The review of the FNAI Biodiversity Matrix indicated that there are no documented or documented historic records of this species from the construction ROI.

⁴⁹ Ibid.

⁵⁰ University of Florida, “University of Florida Herbarium Collections Catalog,” http://www.flmnh.ufl.edu/scripts/dbs/herbs_project/herbsproject/herbs_pub_proc.asp?accno=166387&famsys=A&output_style=Report_type&trys=2, May 9, 2017, (March 5, 2019).

⁵¹ USFWS South Florida Field Office, “Multi Species Recovery Plan,” https://ecos.fws.gov/docs/recovery_plan/140903.pdf; 1999 (March 10, 2019).

3.3.2.4 Species Protected Under Other Federal Laws

Bald and Golden Eagles

Florida is not part of the golden eagle's range. Bald eagles normally forage in large bodies of water, such as coastal areas, bays, rivers, lakes and other waterbodies that have an abundant source of food.⁵² Nearby habitats are used for nesting and roosting. Bald eagles select large trees with strong limbs that can support up to 1,000 pounds in weight of nest material.⁵³ No suitable nesting habitat for the bald eagle occurs within the construction ROI. According to 2016 FWC bald eagle nest location data, the nearest known bald eagle nests are approximately 0.8 mile southeast, 0.85 mile southwest, and 2.56 miles north of the construction ROI. None of these three nests are within the operational ROI. There are seven other bald eagle nests that are within the portion of the operational ROI representing the RLV flight paths over Merritt Island National Wildlife Refuge.

Migratory Birds

Migratory birds use habitats in the construction ROI and operational ROI. The USFWS IPaC report generated for the project listed a total of 59 migratory birds of conservation concern that are known to use habitats within eastern Brevard County and would likely use habitats in the construction ROI and/or the operational ROI. This list included four species of raptors, three species of rails, 12 species of shorebirds, two species of wading birds, seven species of perching birds, 21 species of gulls and gull-like birds, nine species of waterfowl and similar birds, and one species of pelican. Numerous other migratory birds that are not considered to be birds of conservation concern are also likely to utilize the ROIs.

3.3.2.5 State Protected Species

Wading Birds

State-protected wading birds include the little blue heron, reddish egret, and tricolored heron. Suitable foraging habitat for wading birds occurs within the ditches that traverse portions of the construction ROI. No wading bird nesting habitat is present within the construction ROI. The little blue heron was observed in the construction ROI during the WHA. Due to the presence of extensive wetland habitat, wading bird species are likely to use habitats at Merritt Island National Wildlife Refuge within the operational ROI. The

⁵² Nature Serve Explorer, "Comprehensive Report Species – *Haliaeetus leucocephalus*," <http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Haliaeetus+leucocephalus>, March 2018 (March 5, 2019).

⁵³ USFWS, *National Bald Eagle Management Guidelines*, <https://www.fws.gov/northeast/ecologicalservices/pdf/NationalBaldEagleManagementGuidelines.pdf>, May 2007 (March 5, 2019).

FWC wading bird colony data indicates there are six documented wading bird colonies within the portion of Merritt Island National Wildlife Refuge that is overlapped by the operational ROI.

Florida Burrowing Owl

Burrowing owls typically inhabit open areas of grassy prairie-like habitat. The airfield at TIX provides suitable habitat for the Florida burrowing owl, although mowing activities could cause collapsing of burrows if establishment of a territory was attempted at the TIX. No burrowing owls were observed during the WHA. The northwest portion of the construction ROI, which was cleared in 2013 and is currently being maintained in a cleared condition, provides suitable habitat for this species. The February 2019 review of the FNAI Biodiversity Matrix, indicated that there are no documented or documented historic occurrences of this species in the construction ROI. Some areas of suitable open grassy habitat exist within the operational ROI, but the Biodiversity Matrix indicated that there are no documented occurrences of this species within the operational ROI.

Florida Sandhill Crane

Sandhill cranes typically forage within freshwater marshes, prairies, pasture, and other areas of open grass.⁵⁴ They typically nest within open freshwater marsh habitat. The sandhill crane is a species that is known to forage at TIX; however, no suitable nesting habitat for this species occurs within the limits of the construction ROI. The entire grassed airfield, including the northwest portion of the construction ROI, provides suitable foraging habitat for this species. Suitable nesting and foraging habitat for this species occurs within the operational ROI.

American Oystercatcher

The American oystercatcher uses habitats that include beaches, dunes, saltmarsh, spoil islands, and mud flats. There is no suitable habitat for this species in the construction ROI. The operational ROI extends over suitable habitat for this species along the Atlantic shoreline and in the Indian River and Banana River.

Roseate Spoonbill

The roseate spoonbill uses habitats that include coastal marshes, mud flats, mangrove habitat, lagoons, and shallow fresh or saltwater wetlands with muddy substrate. The construction ROI does not contain suitable habitat for this species. The operational ROI extends over suitable habitat for this species along the Indian River and Banana River and within Merritt Island National Wildlife Refuge.

⁵⁴ FNAI, "Field Guide to the Rare Animals of Florida," https://www.fnai.org/FieldGuide/pdf/Antigone_canadensis_pratensis.pdf, 2018 (March 10, 2019).

Black Skimmer

The black skimmer uses habitats that include beaches, estuaries, sandbars, tidal creeks, and inland lakes and flooded fields. It nests on beaches, small islands and occasionally on gravel rooftops near the coast. The construction ROI does not contain suitable habitat for this species. The operational ROI extends over suitable habitat for this species along the Atlantic shoreline and in the Indian River and Banana River.

Least Tern

The least tern uses habitats that include beaches, estuaries, bays, sandbars, lagoons, lakes, and rivers. They nest on sandy or gravelly beaches and riverbanks and occasionally on gravel rooftops near the coast. The construction ROI does not contain suitable habitat for this species. The operational ROI extends over suitable habitat for this species along the Atlantic shoreline and in the Indian River and Banana River.

Gopher Tortoise

Gopher tortoises use upland habitats with sandy well-drained soils. Gopher tortoises were removed within the northwest portion of the construction ROI prior to it being cleared in 2012. They were relocated to an FWC-approved recipient site under a gopher tortoise conservation permit. Tortoises have since been excluded from the northwest portion of the construction ROI by silt fence. The abandoned citrus grove in the portion of the construction ROI south of Runway 18-36 contains gopher tortoise burrows. Gopher tortoises are also known to occur within numerous areas within the operational ROI according to the February 2019 review of the FNAI Biodiversity Matrix.

Florida Pine Snake

The Florida pine snake uses upland habitats with dry sandy soils and predominantly open canopy coverage.⁵⁵ Potential habitat for the Florida pine snake is present throughout the construction ROI, but this species has not been observed in the area. Based on the February 2019 review of the FNAI Biodiversity Index, there are documented historic records of this species from Merritt Island National Wildlife Refuge within the operational ROI.

State Protected Plants

No state-protected plant species are documented to occur within the construction ROI. However, sand-dune spurge, Tampa vervain, hand fern, Titusville balm, pine pinweed, Atlantic coast Florida lantana, and hay-scented fern are known to occur near the construction ROI. The remaining state-protected plant species listed in **Table 3.4** occur

⁵⁵ FNAI, "Field Guide to the Rare Animals of Florida," http://www.fnai.org/FieldGuide/pdf/pituophis_melanoleucus_mugitus.pdf 2001 (March 10, 2019).

within habitat types similar to habitats found in the operational ROI. The complete FNAI list of state protected plants for Brevard County is provided in **Appendix C**.

3.4 CLIMATE

3.4.1 Background

Greenhouse gases (GHGs) are gases that trap heat in the atmosphere. The primary GHGs of concern are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (SF₆). These emissions occur from natural processes and human activities.

3.4.2 Affected Environment

Each GHG is assigned a global warming potential. The global warming potential is the ability of a gas or aerosol to trap heat in the atmosphere. The global warming potential rating system is standardized to CO₂, which has a value of one. For example, CH₄ has a global warming potential of 21, which means that it has a global warming effect 21 times greater than CO₂, on an equal-mass basis. The equivalent CO₂ rate is calculated by multiplying the emission of each GHG by its global warming potential and adding the results together to produce a single, combined emission rate representing all GHGs, and this value is represented by “CO₂e,” which is defined as the carbon dioxide equivalent.

3.5 COASTAL RESOURCES

Relevant federal laws that protect coastal resources include the Coastal Barrier Resources Act (16 U.S.C. § 3501 *et seq.*) and the Coastal Zone Management Act (CZMA) (16 U.S.C. §§ 1451-1466). Passed in 1972, the CZMA provides for the management of the U.S.’s coastal resources in order to, “preserve, protect, develop, and where possible, to restore or enhance the resources of the nation’s coastal zone.”

The ROI for the coastal resources analysis is the Brevard County jurisdictional boundary (**Figure 3-4**). The entire state of Florida is located within a coastal zone. The FDEP, Office of Intergovernmental Programs, and Florida State Clearinghouse coordinate the review of federal actions in Florida for consistency with the Florida Coastal Management Program (FCMP). FDEP manages the FCMP which protects and enhances Florida's natural, cultural, and economic coastal resources. The Florida State Clearinghouse will make a determination of the Proposed Action’s consistency with the FCMP.

The nearest unit of the Coastal Barrier Resources System to the construction ROI is the Canaveral Unit (FL 07P), which is located over 5.4 miles north-northeast of the construction ROI.⁵⁶ Because no coastal barriers are located near the project, no further evaluation effects on coastal barrier resources is warranted.

3.6 DEPARTMENT OF TRANSPORTATION ACT, SECTION 4(f)

3.6.1 Background

Section 4(f) of the Department of Transportation Act of 1966, codified as 49 U.S.C. § 303(c), protects significant publicly owned parks, recreational areas, wildlife and waterfowl refuges, and public or private historic sites. Section 4(f) provides that the Secretary of Transportation may approve a transportation program or project that requires the use of any publicly owned land from a public park, recreation area, or wildlife or waterfowl refuge of national, state, or local significance, or land from any publicly or privately owned historic site of national, state, or local significance, only if there is no feasible and prudent alternative to the use of such land and the program or project includes all possible planning to minimize harm resulting from the use.

The ROI for Section 4(f) resources includes the construction ROI and the surrounding area where potential impacts from launch noise could occur.

3.6.2 Affected Environment

Section 4(f) properties were identified in the vicinity of TIX by reviewing the following data sources:

- Park location data from Brevard County Parks and Recreation⁵⁷ and the City of Titusville;⁵⁸
- GIS mapping from the FNAI depicting properties such as National parks, state forests, wildlife management areas, and local preserves and conservation areas managed by 12 Federal agencies, 23 agencies of the State of Florida, Florida counties, and Florida cities;⁵⁹

⁵⁶ USFWS, "Official CBRS Maps (map 12-041A)," <https://www.fws.gov/cbra/maps/cbrs/>, January 11, 2016 (March 5, 2019).

⁵⁷ Brevard County Parks and Recreation, "Brevard County Parks and Recreation North Area," <http://www.brevardcounty.us/ParksRecreation/North>, (March 5, 2019).

⁵⁸ City of Titusville, "Brevard County Parks & Recreation North Area Locations," <http://www.titusville.com/Page.asp?NavID=1455>, (March 5, 2019).

⁵⁹ FNAI, "Florida Conservation Lands," <http://fnai.org/gisdata.cfm>, January 2019, (March 5, 2019).

- Information provided by the Florida State Historic Preservation Office (SHPO) (see letter in **Appendix B**);
- Information obtained from the National Register of Historic Places;⁶⁰ and
- The cultural resources assessment report that was prepared for this project (**Appendix F**).

Three Section 4(f) properties were identified in the vicinity of TIX, including the Enchanted Forest Sanctuary, Tom Statham Park, and Manatee Hammock Campground (see **Figure 3-6**). The Enchanted Forest Sanctuary is located directly north of TIX. It is a 470-acre wildlife and habitat conservation area that is managed by the Brevard County Environmentally Endangered Lands Program, which is within the Parks and Recreation Department. In addition to providing wildlife and habitat conservation, the Enchanted Forest Sanctuary provides environmental education and passive recreation opportunities for the general public. The section of the sanctuary closest to TIX that is most likely to be affected by noise from TIX contains hydric hammock wetlands and does not include any of the eight existing hiking trails within the sanctuary. Tom Statham Park is a 5.15-acre community park located on the Indian River that features a playground, community center, pavilion, walkways and a boardwalk. The Manatee Hammock Campground is a 26.45-acre campground located just south of Tom Statham Park that features a recreation building, fishing pier, pool, picnic pavilion and other amenities. Both Tom Statham Park and the Manatee Hammock Campground are owned by Brevard County.

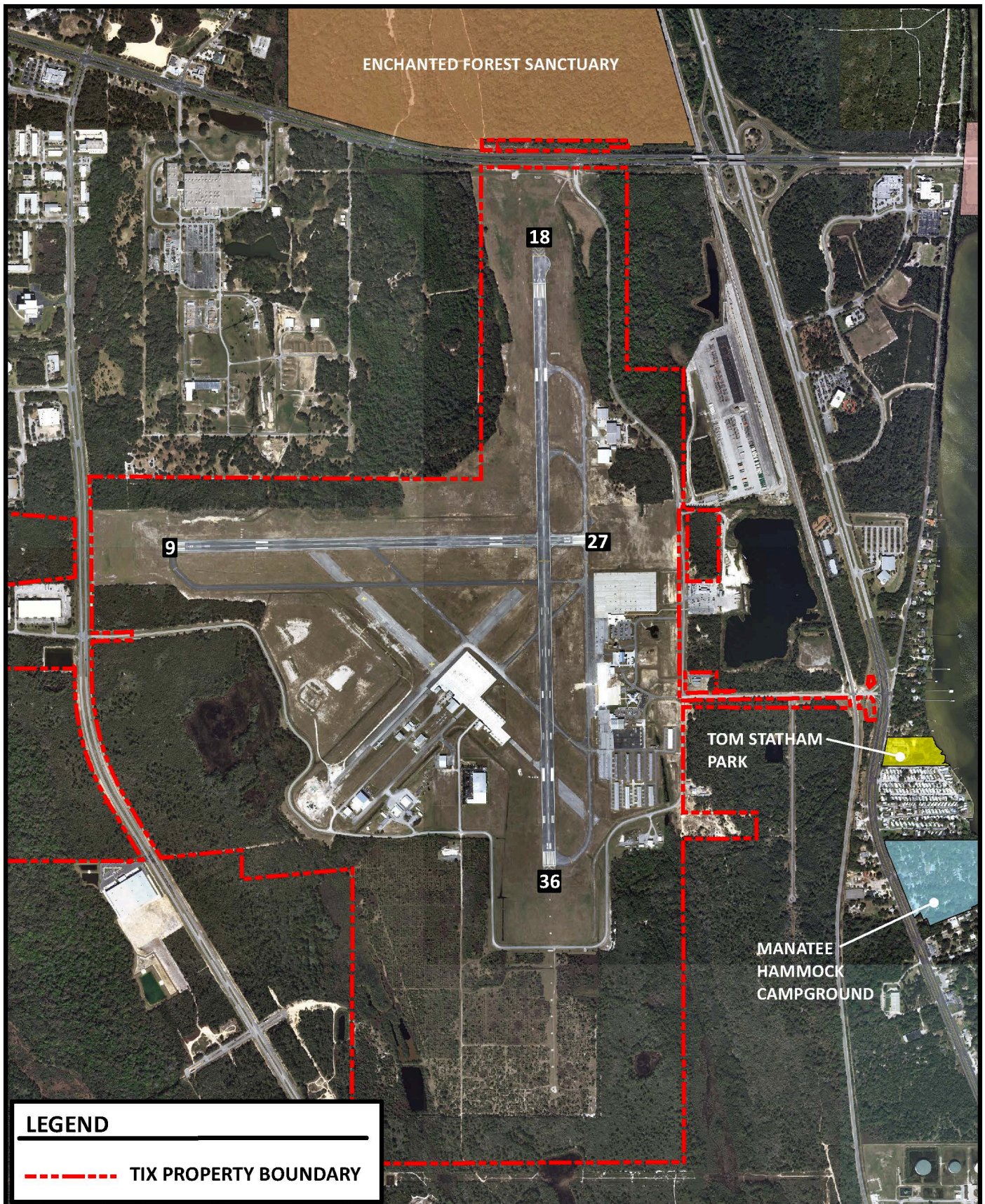
3.7 FARMLANDS

3.7.1 Background

The *Farmland Protection Policy Act* (7 U.S.C. §§4201-4209) was established to minimize the unnecessary and irreversible conversion of farmland soils to nonagricultural uses, and to assure, to the extent practicable, that Federal, state, and local policies are followed to protect farmland soils. Farmland soils can be prime farmland soils, unique farmland soils, or farmland soils of statewide or local importance. Prime farmland soils are defined as

⁶⁰ National Park Service, "National Register of Historic Places," <https://www.nps.gov/subjects/nationalregister/index.htm>, December 3, 2018 (March 5, 2019).

Figure 3-6 Section 4(f) Resources Near TIX



Michael Baker
INTERNATIONAL

Space Coast Regional Airport Spaceport Licensing
Environmental Assessment

**SECTION 4F RESOURCES
NEAR TIX**

0 800 1,600
Scale in Feet

N

3-6

Figure No.

soils that consistently produce the greatest yields with minimal inputs of energy and economic resources farming these soils involves the least environmental impacts.⁶¹ These soils do not have to be presently used as cropland and not all cropland is prime farmland soil. Unique farmland is land that is used for the production of specific high-value food or fiber crops.⁶² Statewide and locally important farmland soils are soils designated in coordination with state and local agencies as important farming areas for food, fiber, forage, and/or oilseed crops.⁶³ Land in urbanized areas or committed to urban development or for water storage is not considered to be farmland.⁶⁴ The ROI for farmlands is the construction ROI (**Figure 3-7**).

3.7.2 Affected Environment

Based on a review of Natural Resources Conservation Service (NRCS) soils data for the construction ROI, 84.6 acres of the 231.8-acre ROI are categorized as “not prime farmland” or as “water.”⁶⁵ The remaining 147.2 acres of land within the construction ROI are categorized as farmland soils of unique importance, including Candler fine sand (88 acres), Myakka sand (30.1 acres), and Tavares fine sand (29.1 acres).

3.8 HAZARDOUS MATERIALS, SOLID WASTE, AND POLLUTION PREVENTION

3.8.1 Background

An airport’s airside and landside operations routinely involve the transportation, use, and storage of hazardous materials. Airport activities may also generate hazardous waste. For example, ground vehicles, aircraft refueling trucks, and/or hydrant systems transport hazardous materials such as jet fuels to TIX.

Federal, state, and local laws regulate the transportation, storage, and use of hazardous materials and the disposal of hazardous wastes. These laws extend to past, present, and future landowners of properties containing hazardous materials. Development or other activities disturbing sites containing hazardous materials may create pathways that allow contaminants to affect human health and the environment.

⁶¹ 7 U.S.C. §4201(c)(1)(A).

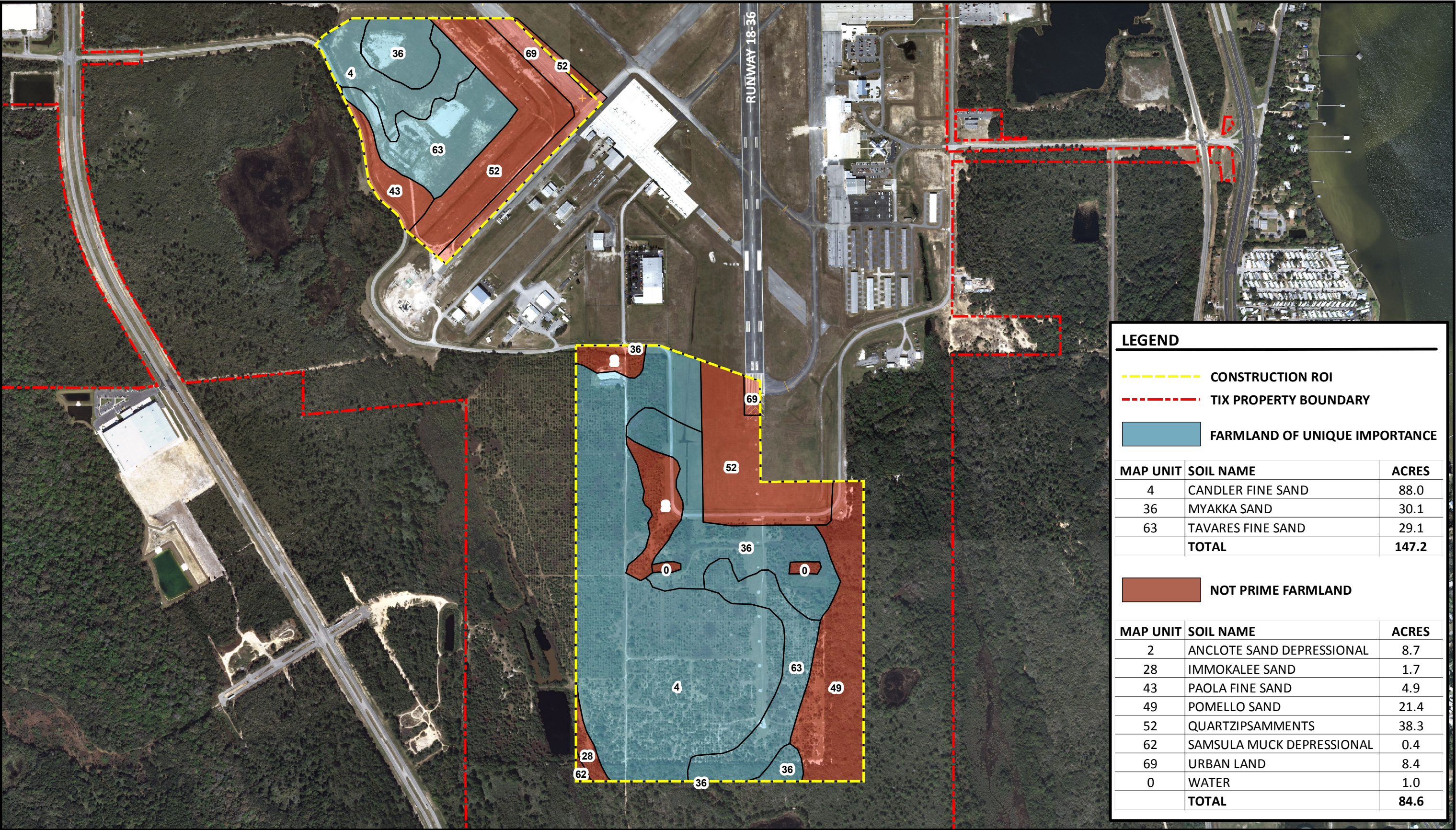
⁶² 7 U.S.C. §4201(c)(1)(B).

⁶³ 7 U.S.C. §4201(c)(1)(C).

⁶⁴ 7 CFR §658.2(a).

⁶⁵ NRCS, Web Soil Survey, <http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>, (March 5, 2019).

Figure 3-7 NRCS Farmland Soils



Federal laws and Executive Orders that manage hazardous materials include:

- Comprehensive Environmental Response, Compensation, and Liability Act of 1980;⁶⁶
- Oil Pollution Prevention Act of 1990;⁶⁷
- Toxic Substances Control Act of 1976;⁶⁸ (TSCA)
-
- Resource Conservation and Recovery Act (RCRA);⁶⁹
- Clean Water Act (CWA);⁷⁰
- Executive Order 12088, *Federal Compliance with Pollution Control Standards*;⁷¹
- Executive Order 12856, *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements*;⁷² and
- Executive Order 12580, *Superfund Implementation*.⁷³

The terms “hazardous waste,” “hazardous substance,” and “hazardous material” are generally associated with industrial wastes, petroleum products, and other contaminants.⁷⁴ Below are the technical meanings of each term:

- Hazardous waste: Solid waste that is ignitable, corrosive, reactive, or toxic. These are also known as “characteristic wastes.” The USEPA has deemed certain solid wastes hazardous. These may be referred to as “listed wastes.”⁷⁵
- Hazardous substance: Includes hazardous waste, HAPs, hazardous substances as defined under the CWA and TSCA, and elements, compounds, mixtures, solutions, or substances listed in 40 CFR Part 302 that pose substantial harm to human health or environmental resources. Hazardous substances do not include any petroleum or natural gas substances and materials pursuant to Comprehensive Environmental Response, Compensation, and Liability Act of 1980.
- Hazardous material: Any commercially transported substances or materials that pose unreasonable risk to public health, safety, and property. Hazardous materials include hazardous waste and hazardous substances, as well as petroleum and natural gas materials and substances.⁷⁶

⁶⁶ 42 U.S.C. Section 9601.

⁶⁷ 33 U.S.C. Section 2701.

⁶⁸ 15 U.S.C. Sections 2601-2692.

⁶⁹ 42 U.S.C. Section 6901 *et. seq.*

⁷⁰ 33 U.S.C. Sections 1251-1387.

⁷¹ Vol. 43, *Federal Register*, page 47707, October 1987.

⁷² Vol. 58, *Federal Register*, page 41981, August 1987.

⁷³ Vol. 52, *Federal Register*, page 2923, October 1987.

⁷⁴ FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, July 2015, Exhibit 4-1, p. 4-7.

⁷⁵ 40 CFR Part 261, Subpart C.

⁷⁶ 49 CFR Part 172, Table 172.101.

The ROI for this environmental impact category is the construction ROI.

3.8.2 Affected Environment

TIX is not included on the USEPA's National Priorities List. TIX currently adheres to the regulations outlined in Volume II, Chapter 35, Article VI, *Hazardous and Toxic Materials Management*, of the City of Titusville Land Development Code. Article VI controls and regulates the emission, storage, and movement of hazardous waste, toxic materials, and substances.

Sections 4 and 5 of TCAA's Rules and Regulations outline the storage, handling, and disposal of hazardous materials, including fuel-handling procedures.⁷⁷ Applicable local, state, and Federal codes, standards, and recommended practices for safe handling and operations that involve hazardous materials are adopted by reference as part of TCAA's rules and regulations on safe handling and transportation of various propellants and fuels proposed for use in RLVs, as well as the use of setbacks and recommended safe distances from these materials that is required to protect operations of other aircraft and facilities at TIX.

TIX currently uses and manages hazardous materials. TIX's fuel farm is located in the southeastern portion of TIX's property. TIX has 100LL Jet-A Fuel available for its users. There are tanker trucks and a self-serve fuel pump west of Runway 18-36, near the Space Coast Jet Center.

There are 12 RCRA facilities on TIX property. **Table 3.7** provides the name, address, and handler ID for each RCRA facility. All these sites are located outside the construction ROI. FDEP identifies Executive Aircraft Painting, Brevard County Mosquito Control, TCAA, Bristow Academy and Professional Aircraft Accessories as small quantity generators of hazardous waste.⁷⁸

Pollution Prevention

There is no treatment or disposal of hazardous waste at TIX. Hazardous waste (oil, solvents, etc.) and municipal solid waste (food containers, cardboard packaging, and plastic) currently generated at TIX are removed for appropriate off-site recycling or disposal. Spill prevention countermeasure control plans help prevent any discharge of oil

⁷⁷ TCAA Rules and Regulations for Arthur Dunn Airpark, Merritt Island Airport, and Space Coast Regional Airport, November 19, 2002.

⁷⁸ USEPA, NEPAassist Tool, <http://nepassisttool.epa.gov/nepassist/entry.aspx>, (March 5, 2019).

Table 3.6 RCRA Facilities within TIX Property		
Facility Name	Facility Address	Handler ID
Aircraft Engine Services, LLC	380 Golden Knights Blvd.	FLR000150789
Cadiz Aircraft Maintenance	7003 Challenger Ave.	FLR000102558
Executive Aircraft Painting	7000 Challenger Ave.	FLD982091738
Brevard County Mosquito Control	800 Perimeter Rd.	FLR000102566
Professional Aircraft Accessories	7035 Center La.	FLR000103531
HIS Painting	6975 Tico Rd.	FLR000061994
Central Sand Inc.	6855 Tico Rd.	FLR000225722
Debenair Aviation Services	365 Golden Knights Blvd. #A	FLR000102566
Helicopter Adventures	365 Golden Knights Blvd. #B	FLR000102574
Bristow Academy	365 Golden Knights Blvd.	FLR000067819
Titusville – Cocoa Airport Authority	355 Golden Knights Blvd.	FLR000102673
TICO Executive Aviation	370 Golden Knights Blvd.	FLR000102665
Source: USEPA, NEPAassist Tool, http://nepassisttool.epa.gov/nepassist/entry.aspx , (March 5, 2019).		

into navigable waters. Fixed-base operators at TIX, Bristow Air Center and the Space Coast Jet Center, each have a spill prevention countermeasure control plan.

Solid Waste

The City of Titusville Solid Waste Division is responsible for the collection and removal of garbage and recycling items within the city limits of Titusville. Their services include household garbage, recycling, and yard waste pickup. The Solid Waste division collects garbage from the dumpsters at TIX on Tuesday and Friday of each week as requested by TIX. Brevard County's Central Disposal Facility is located on Adamson Road in Cocoa, FL. The property was first used for solid waste disposal in the 1960's. It is estimated Brevard County Central Disposal Facility has enough capacity to handle class I disposal needs for the county.⁷⁹ However, current and planned expansions at this facility are anticipated to add up to twenty years of life to its current capacity.⁸⁰

⁷⁹ Brevard County, "Solid Waste Management Department's Central Disposal Facility," <http://www.brevardcounty.us/SolidWaste/TourFacility>, (March 5, 2019).

⁸⁰ Personal communication, Deborah Lugar, Assistant Director, Brevard County Waste Management District, February 27, 2018.

3.9 HISTORICAL, ARCHITECTURAL, ARCHEOLOGICAL, AND CULTURAL RESOURCES

3.9.1 Background

The National Historic Preservation Act (NHPA) of 1966, as amended, established the federal policy for the identification and preservation of historic resources in the U.S. Section 106 of NHPA, as amended, and its implementing procedures (36 CFR Part 800), requires Federal agencies to consider the effects (direct and indirect) of their undertakings on historic or archaeological resources that are listed in or eligible for inclusion in the NRHP, termed “Historic Properties” and to afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment. In addition, Section 106 requires that federal agencies consult with the ACHP, State Historic Preservation Offices (SHPO), Tribal Historic Preservation Offices (THPO), and other consulting parties having an interest in the undertaking’s effect on Historic Properties.

Other statutes, regulations and Executive Orders (EOs) also may apply:

- *The Archeological and Historic Preservation Act of 1974 (AHPA)*;⁸¹
- *The American Indian Religious Freedom Act of 1978 (AIRFA)*;⁸²
- Executive Order 13007, *Indian Sacred Sites*;⁸³ and
- Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*.⁸⁴

NHPA requires Federal agencies to survey, recover, and preserve Historic Properties that federally approved or financed projects may destroy or cause irreparable harm

AIRFA protects the rights of American Indians, Eskimos, Aleuts, and Native Hawaiians to conduct traditional religious services without interference. In doing so, AIRFA preserves the following activities for those entities:

- Access to sacred sites and freedom to worship on those sites through ceremonies and traditional rights;
- Use and possession of objects considered sacred;
- Elimination of interference with freedom to exercise Native religions; and
- Accommodation of access to and use of religious sites provided the access does not interfere with an agency’s essential functions.

⁸¹ 16 U.S.C. Section 469.

⁸² 42 U.S.C. Section 1996.

⁸³ Vol. 61, *Federal Register*, page 26771, May 1996.

⁸⁴ Vol. 36, *Federal Register*, page 8921, May 1971.

Executive Order 13007 protects and preserves Indian religious practices. This executive order directs federal agencies to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners. Federal agencies must also avoid adversely affecting the physical integrity of such sacred sites.

Executive Order 13175 directs Federal agencies to establish procedures to consult and collaborate with tribal governments when agency policies or an agency undertaking may have tribal implications. Compliance with Executive Order 13175 requires consultation with the proper tribal governments.

For the purpose of this EA, historic, archaeological, and cultural resources are districts, sites, buildings, structures, objects, landscapes, and Native American Traditional Cultural Properties included in or eligible for listing on the NRHP. NRHP properties are nationally important due to their significant and respective roles in American history, architecture, archaeology, engineering, and culture. Regulations at 36 CFR part 800 *et seq.* provide detailed instructions to FAA and other Federal agencies on how to assess and address effects on those historically significant properties.

3.9.1.1 Consultation

As part of the early Tribal coordination efforts associated with this project, several Native American Tribal entities were contacted to inform them of the preparation of this EA and to request their comments concerning the potential licensing and establishment of a spaceport at TIX as well as any information that they might have concerning sensitive resources in the vicinity of the project. Based on the FDOT Environmental Management Office, Native American Coordination office, the following Native American Tribal Entities were initially contacted:

- The Miccosukee Tribe of Indians of Florida,
- The Mississippi Band of Choctaw Indians,
- The Muscogee (Creek) Nation,
- The Poarch Band of Creek Indians,
- The Seminole Tribe of Florida, and
- The Seminole Nation of Oklahoma.

Michael Baker Inc. sent early coordination letters to Native American entities on August 6, 2013. **Appendix B1** contains the early coordination letter and the distribution list. None of the Native American entities contacted indicated concern for potential impacts to Native American resources as a result of the proposed spaceport. The only response received was a request by the Mississippi Band of Choctaw Indians to be removed from

the project correspondence list. Due to the location of the project, this Native American Tribe requested to be removed from the distribution list.

A second coordination letter from the FAA with a copy of the cultural resources assessment report was sent to Paul Backhouse of the Tribal Historic Preservation Office Seminole Tribe of Florida on August 28, 2015. The FAA received a response from Bradley Mueller of the Tribal Historic Preservation Office on September 9, 2015. Copies of the correspondence are contained in **Appendix B4**.

Consultation with the SHPO was also initiated with the August 6, 2013, early coordination letter. The SHPO's August 21, 2013, response letter can be found in **Appendix B3**. In March of 2016, delineation of the ROI/Area of Potential Effect (APE) for this environmental resource was established in coordination with SHPO to encompass the construction ROI (refer to **Figure 3-2**) for potential direct impacts and the noise ROI for potential indirect impacts (refer to **Figure 3-10**).⁸⁵ The potential sonic booms of the RLVs were considered in the development of the APE, however, these areas are too far away from the Florida coast to be a direct or indirect impact (see **Figure 3-3** for a depiction of the extent of the sonic booms associated with the RLV concepts evaluated in this EA).

3.9.2 Affected Environment

3.9.2.1 Historical Resources

The U.S. Government constructed TIX, originally called the Titusville-Cocoa Airport, in 1943 to serve as a supplementary airfield to the Sanford Naval Air Station during World War II. TIX property was transferred to the City of Titusville and the City of Cocoa in 1947, after the war. The property was then transferred to TCAA in 1961.

Following a review of the National Park Service NRHP dataset of listed, returned, removed, eligible, and ineligible resources as well as a review of the National Park Service NRHP GIS mapserver data, it was determined that, as of September 20, 2018, there are 42 NRHP-listed resources and no other documented resources that are eligible for listing in Brevard County.⁸⁶ No historic structures (50 years of age or greater), including properties currently listed or determined eligible for listing in the NRHP, were previously recorded within the APE. The closest NRHP-listed resource is Old St. Luke's Episcopal Church and Cemetery (#90000848). Listed in 1990, this historic property is located in Courtenay, approximately 5.50 miles southeast of the APE.

⁸⁵ Personal Communication, Ms. Mary Berman, Florida Division of Historical Resources, March 14, 2016.

⁸⁶ National Park Service, *National Register of Historic Places Program: Research – Data Downloads*, https://www.nps.gov/nr/research/data_downloads.htm, (February 14, 2019).

The SHPO also maintains the Florida Historical Marker Program. This program recognizes historical resources, persons, and events considered significant with regard to architecture, archaeology, Florida history, and traditional culture. There are 46 historical markers in Brevard County. The Addison/Ellis Canal is the closest historical marker to the study area. The canal historical marker is approximately 0.10-mile north of the study area and outside of the APE.

Examination of Brevard County Property Appraiser information and historic aerial photographs indicated the potential for five unrecorded historic structures within the APE. As a result of the historical/architectural survey (**Appendix F**), six historic resources were newly identified and recorded. These include one resource group, the Space Coast Regional Airport (8BR03285), and five individual buildings: the former Eastern Airlines Terminal (8BR03286), Hangar # 1 (8BR03287), Hangar T4 (8BR03288), Hangar T5 (8BR03289), and Hangar # 2 (8BR03290). All five buildings are considered part of the larger Space Coast Regional Airport (TIX) resource group.

Although TIX was constructed by the U. S. government as part of the war effort during World War II, its two oldest features, the two runways, exhibit considerable physical deterioration and loss of historic integrity. The current physical appearance, setting, and feeling of the resource group do not reflect its World War II period of significance. Instead, they reflect the use of a regional civilian airport. In addition, research did not reveal an association with significant historical events or persons during World War II or after its conversion into a regional airport. Furthermore, the five surveyed structures and features of TIX are typical examples of their type without any design features, or historical associations that would make them significant individually or part of a larger resource or district. These six resources are considered not eligible for listing on the NRHP; therefore, they are not considered Historic Properties for the purposes of Section 106.

3.9.2.2 Archaeological Resources

Based on the *Phase I Cultural Resource Assessment Survey of the Space Coast Regional Airport, Brevard County, Florida July 2015* (**Appendix F**), a review of the Florida Master Site File indicated that no previously recorded archaeological sites are located within the APE. Relevant site location information for environmentally similar areas within Brevard County and the surrounding region indicated a moderate to low probability for the occurrence of prehistoric sites in the APE. The background research also indicated that sites, if present, would most likely be small lithic or artifact scatters.

A field survey was conducted by Archaeological Consultants, Inc. for this Proposed Action in June 2015. Archaeological field survey methods consisted of ground surface reconnaissance and subsurface testing. Subsurface testing was systematically carried out

at 164 ft (50 m) intervals. Shovel tests were circular and measured approximately 1.6 ft (0.5 m) in diameter by at least 3.3 ft (1 m) in depth. All soil removed from the test pits was screened through a 0.25 in (6.4 mm) mesh hardware cloth to maximize the recovery of artifacts. The locations of all shovel tests were plotted on aerial maps. Following the recording of relevant data such as stratigraphic profile and artifact finds, all test pits were refilled. No cultural materials were recovered, and thus, no analysis was needed. No archaeological sites were discovered during the survey (see **Appendix F**).

As the result of background research and archeological and historical/architectural field surveys, no Historic Properties listed in, or eligible for listing in, the NRHP were identified within the APE. For additional information, refer to the *Phase I Cultural Resource Assessment Survey of the Space Coast Regional Airport, Brevard County, Florida July 2015* (**Appendix F**).

3.10 LAND USE

3.10.1 Background

Compatibility issues between airports and surrounding land use types are typically associated with noise impacts from aircraft operations. However, land use compatibility issues can also occur due to the presence of obstructions, wildlife attractants, community disruption, potential relocations, negative visual impacts, or induced socioeconomic impacts.

Land use planning and control is provided to ensure safe aircraft operations within an airport and its surrounding navigable airspace and to prevent noise-related incompatibilities. The FAA does not have the authority to control land use within the jurisdiction of local governments, but offers guidance in land use compatibility planning.⁸⁷ FAA project grant approval requirements found at 49 U.S.C. 47106(a)(1) state the U.S. Secretary of Transportation can only approve an FAA project grant if the project is not in conflict with development plans of the public agencies tasked with land use planning in the area of the proposed project. The Airport and Airway Improvement Act, 49 U.S.C. 47107(a)(10), stipulates that the FAA may not provide Airport Improvement Project funding unless assurances are provided that zoning laws have been or will be adopted to restrict land uses adjacent to airports to those that are compatible with airport

⁸⁷ FAA, *Land Use Compatibility and Airports*, http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/planning_toolkit/media/III.B.pdf (March 10, 2019).

operations. Similarly, Chapter 333 of the Florida Statutes, *Airport Zoning*, requires local governments to adopt, administer, and enforce airport zoning regulations to protect the state's airports from incompatible development.

Other regulations deal specifically with limiting land use incompatibility associated with hazards to aircraft operations caused by wildlife attractants which increase the likelihood of bird-aircraft collisions. For example, regulations at 40 CFR § 258.10 require operators of municipal solid waste landfills within 10,000 feet of runways serving turbojet aircraft to demonstrate the landfills are designed and operated in a manner that does not cause bird hazards for aircraft. FAA Advisory Circular 150/5200-33B establishes recommended separation distances for hazardous wildlife attractants relative to an airport's air operations area. For airports serving turbine powered aircraft, a 10,000-foot separation distance is recommended. Furthermore, Advisory Circular 150/5200-33B recommends a separation distance of five miles if a hazardous wildlife attractant could cause hazardous wildlife to move into or across approach or departure airspace.

Chapter 59, Article VIII of the City of Titusville Land Development Regulations contains the specifications for the zoning overlay districts within the city limits. Article VIII, Division 4, Part 2 describes the zoning criteria for the Airport Impact Area Overlay District associated with TIX. The overlay district zoning regulations, which include an Airport Height Notification Zone, an Airport Runway Protection Zone, and an Airport Noise Impact Zone, detail the allowable types of land use within the zones and the requirements for preventing obstructions. Multiple factors were considered in defining the ROI for land use, including:

- No municipal solid waste landfills occur within distances established by 40 CFR § 258.10 or recommended separation distances established in Advisory Circular 150/5200-33B.
- Although the western boundary of Merritt Island National Wildlife Refuge is located approximately 4.2 miles from the Airport Operating Area (within the five-mile separation criterion established in Advisory Circular 150/5200-33B for the protection of approach and departure airspace), it is unlikely that the wildlife attracted to the refuge will be caused to move into or across the approach or departure airspace associated with TIX.
- As described in **Section 3.1**, there are no properties adjacent to TIX that would be likely to experience visual impacts as a result of the alternatives under consideration.

Accordingly, it was determined that for evaluating land use compatibility issues not related to noise, the construction ROI would be used.

3.10.2 Affected Environment

Current land use within the vicinity of TIX was determined using GIS zoning data from the Brevard County Planning and Development Department and the City of Titusville Planning and Growth Management Department and verified using field reconnaissance and review of aerial photography. The construction ROI, which is 231 acres in size, is located completely within existing TIX property, and is entirely within the limits of the City of Titusville. **Figure 3-8** depicts city zoning designations within the construction ROI. The predominant zoning designation within the construction ROI is Public Use (213.2 acres), which is the designation that the city has assigned to the developed portion of TIX and some of the adjacent lands within the TIX property boundary.

Approximately 86 acres of the Public Use designated area within the construction ROI is cleared, mowed and maintained as part of the airfield or occupied by airfield pavements and buildings. The remaining 127 acres zoned Public Use within the construction ROI consist predominantly of an abandoned citrus grove. The Public Use designation is assigned to districts consisting of property owned by any government entity (local, state, or Federal), with the caveat that the land within the district is “particularly and peculiarly related to the public welfare.”⁸⁸

Approximately 13 acres of undeveloped, forested land south of Perimeter Road, adjacent to the south and east sides of the abandoned orange grove off the approach end of Runway 36, is zoned Heavy Industrial (or Industrial). According to the City of Titusville’s Land Development Code, the Industrial designation is applied to areas reserved for heavy and extensive industrial activity, wholesaling, warehousing, and distribution. These districts are located away from residential uses and low-intensity commercial uses.⁸⁹

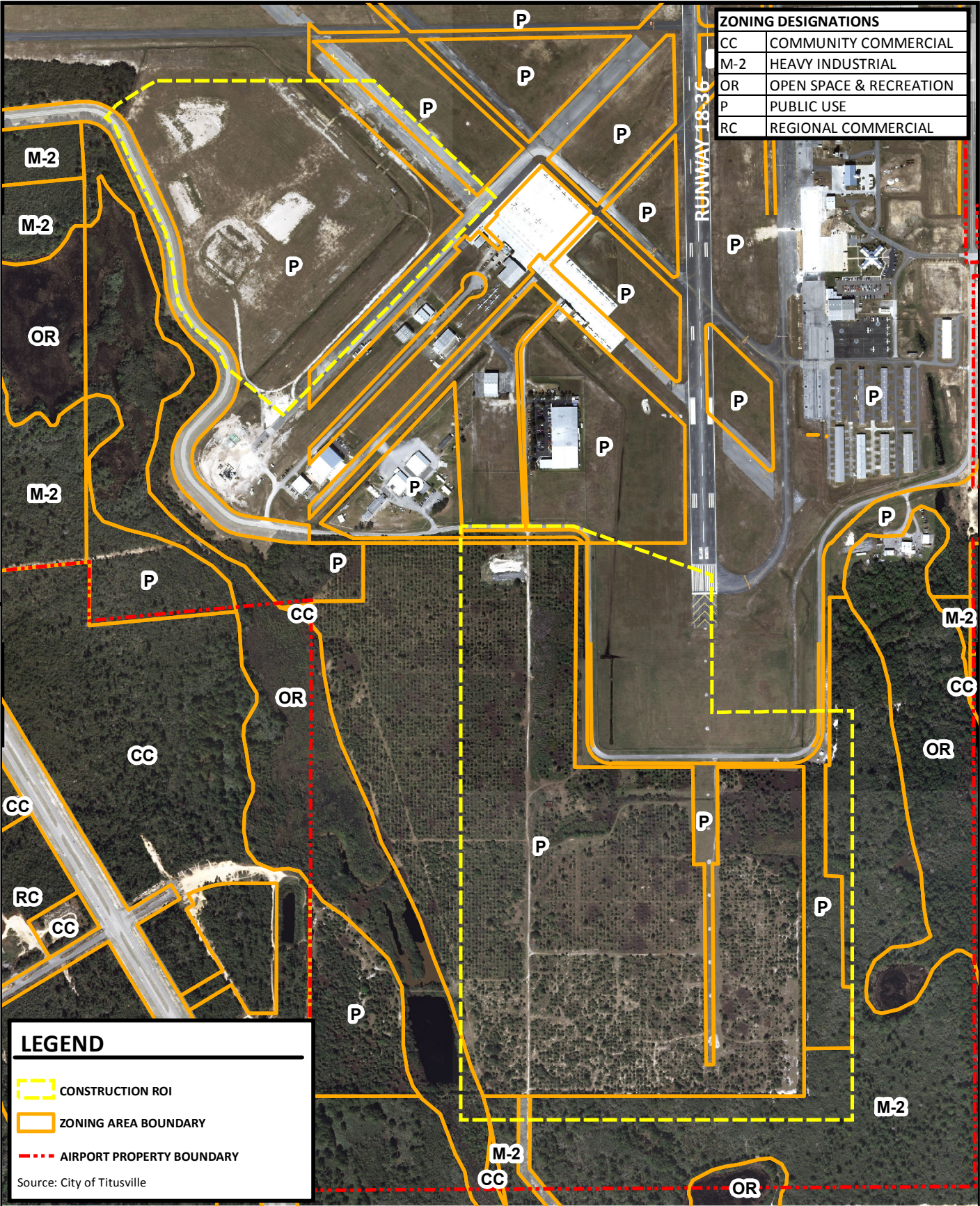
Approximately one acre of undeveloped, forested land in the southwestern corner of the construction ROI is zoned Open Space and Recreation. The Open Space and Recreation designation is intended to provide for the protection and conservation of sensitive lands.⁹⁰ It is assigned to areas to allow residents to enjoy the benefits of the natural environment.

⁸⁸City of Titusville, *Code of Ordinances*, Sec. 28-323, <http://library.municode.com/index.aspx?clientId=12259> January 29, 2019 (March 5, 2019).

⁸⁹ City of Titusville, *Code of Ordinances*, Sec. 28-318, <http://library.municode.com/index.aspx?clientId=12259> January 29, 2019 (March 5, 2019).

⁹⁰City of Titusville, *Code of Ordinances*, Sec. 28-322, <http://library.municode.com/index.aspx?clientId=12259> January 29, 2019 (March 5, 2019).

Figure 3-8 Zoning within Construction ROI



3.11 NATURAL RESOURCES AND ENERGY SUPPLY

3.11.1 Background

While there are no special-purpose laws associated with this impact category, Executive Order 13123, *Greening the Government Through Efficient Energy Management*⁹¹ targets significant reduction of emissions and reduction in energy related spending by encouraging sustainability initiatives, use of renewable energy resources, water conservation, and more efficient use of energy at federal government facilities.

Additionally, FAA policy encourages the incorporation of sustainability measures in facility design to conserve energy and reduce pollution.⁹²

The ROI for natural resources and energy supply is the Brevard County jurisdictional boundary (**Figure 3-4**).

3.11.2 Affected Environment

Energy supply for TIX is provided by the local electrical utility company, Florida Power and Light. Energy supply demands at TIX include energy used for runway lighting and navigational aids on the airfield and lighting, heating and air conditioning, and other power needs of hangars and other buildings on-airport. Fuel for aircraft at TIX is provided by two fixed-based operators that dispense Jet A and Avgas aviation fuels. Water is obtained from the City of Titusville water utility and is sourced from the city's wellfields. Treatment of wastewater from TIX is provided by the City of Titusville's municipal sanitary sewage treatment system. The primary materials that would be utilized for construction of the Proposed Project would be concrete and asphalt. A very rough estimate for the amount of these materials required would be 31,500 cubic yards of new concrete and 9,600 cubic yards of new asphalt. Additional materials such as steel for concrete reinforcement, limerock for use as a base for pavements, and materials for construction of the RLV manufacturing building would be required. Amounts of these materials used would be determined during the design phase.

Other resources used during operation of a spaceport would include fuels and oxidizers, as well as water and electricity consumption at the RLV manufacturing building.

⁹¹ Vol 64 *Federal Register*, page 30851, June 1999.

⁹² FAA, Order 1053.1B *Energy and Water Management Program for FAA Buildings and Facilities*, <http://www.faa.gov/documentLibrary/media/Order/1053.1B.pdf>, April 8, 2013 (March 5, 2019).

3.12 NOISE AND NOISE-COMPATIBLE LAND USE

3.12.1 Background

The noise ROI is defined by the 2018 Proposed Action Day-night average sound level (DNL) 65 dBA noise contour, because the noise analysis found that the extent of the Proposed Action DNL 65 dBA noise contour was greater in 2018 than in the other year modeled, 2023. The sonic boom footprints are not part of the noise ROI because the limits of the sonic boom footprints are over four miles offshore from the Atlantic shoreline and would not affect noise sensitive areas.

Land Development Regulations of the City of Titusville (enacted March 12, 2013) describe the requirements for development within the Space Coast Regional Airport Impact Overlay District. Those requirements pertain to height restrictions within the approach areas, land use restrictions within the Runway Protection Zones and Airport Noise Impact Zone, and other land development regulations around TIX. As shown in **Figure 3-9**, the following land uses are prohibited within the Airport Noise Impact Zone (generalized descriptions are provided):

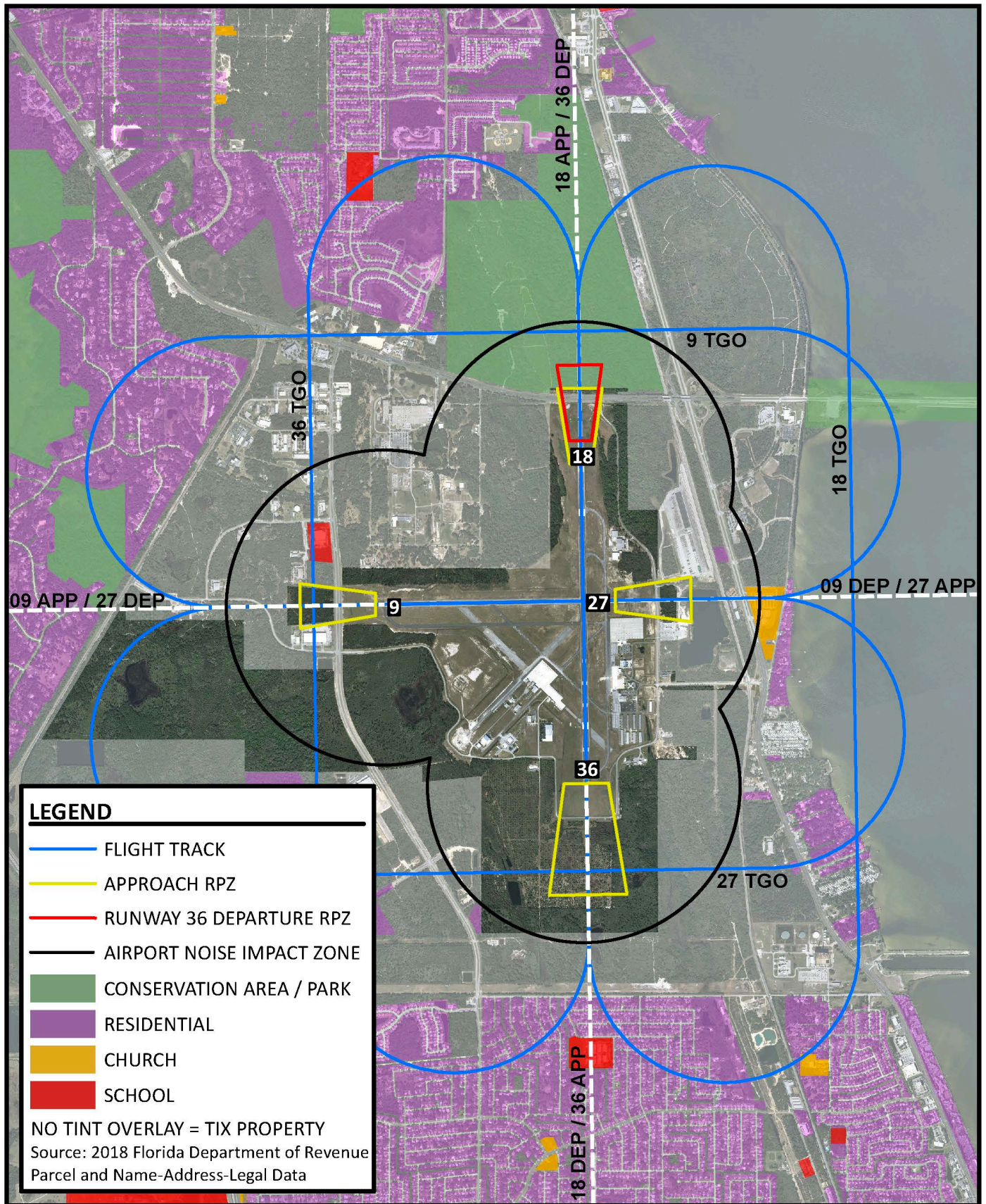
- Educational, Residential, and Similar Uses (unless designed to provide at least 25 dB of indoor noise level reduction).
- Animal Hospitals, Veterinarian Clinics, and Similar Uses (depending upon the building to floor area ratio and treatment capacity).
- Hospitals, Homes for the Aged, Places of Religious Assembly, Auditoriums, Concert Halls, and Similar Uses (unless designed to provide at least 25 dB of indoor noise level reductions).

Consequently, the area surrounding TIX is buffered from land uses that are sensitive to airport noise exposure such as homes, schools, places of worship, and hospitals.

Figure 3-9 also illustrates the generalized aircraft flight tracks for each runway end. For the purposes of this EA, the flight tracks were modeled as standard straight-in and straight-out procedures for itinerant operations and as standard left-hand patterns for local touch- and-go procedures. At the time this EA was begun, the Integrated Noise Model (INM, version 7.0d) was the FAA's approved computer program for generating airport noise contours. This EA and its noise analysis were begun prior to the FAA's adoption of Aviation Environment Design Tool.⁹³ INM computes DNL contours which adds

⁹³ In May 2015 INM was replaced by Aviation Environmental Design Tool, Version 2b. However, projects started with the INM (including this EA) continue to use the INM.

Figure 3-9 Existing Flight Tracks and Airport Noise Impact Zone



a 10-dB penalty to aircraft operations that occur during the nighttime hours between 10:00 p.m. and 6:59 a.m. to account for people's heightened sensitivity during that period. Analysis of RLV launch noise uses a non-standard noise methodology. This methodology was reviewed and approved by the Office of Environment and Energy and is discussed further in **Section 4.12**.

The percentage of operations that occur during daytime and nighttime hours was determined by reviewing historical flight plan activity data, which consists of aircraft that fly under Instrument Flight Rules conditions and/or within controlled airspace. From June 1, 2012 to May 31, 2013, it was found that 13.58% of TIX operations occurred during nighttime hours. For the baseline noise analysis, that value was applied to itinerant GA operations and to the Schweizer 300C helicopter; however, for local GA operations, military operations, and the other helicopter models, a day/night split of 95 percent day/5 percent night was used. The runway use factors shown below were obtained from the 2005 master plan and were also used in the baseline noise analysis. These runway use percentages are consistent with the operations from June 2012 to May 2013:

- Runway 9 – 26%
- Runway 27 – 14%
- Runway 18 – 18%
- Runway 36 – 42%

As discussed previously, the noise ROI is the 2018 Proposed Action DNL 65 dBA noise contour because, of the years modeled, this is the year with the most forecast operations and the alternative that results in the largest DNL 65 dBA noise contour.

3.12.2 Operations Forecast

As shown in **Table 3.8**, the 2015 activity characteristics were obtained from the FAA's Air Traffic Activity Data System database, which documents the airport's historical itinerant and local operations as reported by the Airport Traffic Control Tower. Itinerant operations are arrivals or departures that do not remain within the airport traffic pattern and/or are originating from another airport (i.e., visiting aircraft) and local operations that remain within the airport traffic pattern and are mostly associated with training activity and flight instruction.

In 2015 (October 1, 2014 to September 30, 2015), TIX experienced 108,872 total operations, consisting of 51,179 itinerant operations and 57,693 local operations. The number of operations by aircraft type was determined by obtaining flight-plan activity data from the FAA's Traffic Flow Management System Counts database for the same period.

Table 3.7 Operations by Aircraft Type (2015)							
Year	Total	Single-Engine Piston	Multi-Engine Piston	Turboprop	Jet	Helicopter	Military
2015	108,872	51,093	17,031	398	702	39,193	455
Sources: Michael Baker International, Inc., FAA Air Traffic Activity Data System database, and FAA Traffic Flow Management System Counts database, 2015.							

3.12.3 Fleet Mix

The INM fleet mix was also determined by reviewing historical activity data from the FAA's Traffic Flow Management System Counts database. As shown in **Table 3.9**, several INM aircraft were selected to represent TIX's fleet mix and were grouped into the categories GA Itinerant, GA Local, GA Helicopter, and Military. Because it is not possible within INM to model every single type of aircraft that operates at TIX, each INM aircraft may represent several other aircraft with similar noise profiles. However, all aircraft were matched up with approved substitutions as listed in the database of INM aircraft.

3.12.4 Existing Noise Analysis

The previously described activity variables were entered into the FAA's most recent version of INM (Version 7.0d) to generate existing noise contours for TIX. The noise contours illustrate the DNL, which represents TIX's sound exposure during an average annual day. As previously mentioned, INM adds a 10-dB penalty to every operation that occurs during nighttime hours (10:00 p.m. to 6:59 a.m.) to compensate for people's heightened sensitivity during that period. Federal Aviation Regulations Part 150, Airport Noise Compatibility Planning, identifies the land use compatibility guidelines for various DNL ranges (see **Table 3.10**). All land uses are compatible with a DNL of 65 dB or less, while homes, schools, hospitals, and places of worship are typically not compatible with a DNL between 65 and 70 dB unless additional sound level reduction measures are incorporated into the structure. As such, the existing noise analyses for TIX focused on evaluating the DNL 65 dB contour and higher and any potential impacts to sensitive land uses.

The Land Development Code of Titusville, Florida does not specify regulations for noise levels less than 65 dB. **Figure 3-10** illustrates the DNL 65 dB, 70 dB, and 75 dB noise contours for 2015 operations at TIX. The 2015 DNL 65 dB contour only extends off TIX property to the east, where it extends over an area of industrial land use. The noise ROI,

Table 3.8
TIX INM Fleet Mix (2015)

Group	INM Code	Model	Engine Type	Engines	MTOW	2015 Ops	Day %	Night %
GA IT	GIV	Gulfstream IV	Jet	2	74,600	105	86.4	13.6
GA IT	GII	Gulfstream II	Jet	2	64,800	0	86.4	13.6
GA IT	CL601	Challenger 601	Jet	2	43,100	140	86.4	13.6
GA IT	SD330	Shorts 330	Turbo-prop	2	22,900	40	86.4	13.6
GA IT	CNA560XL	Cessna 560XL	Jet	2	20,000	105	86.4	13.6
GA IT	LEAR35	Lear 35	Jet	2	18,300	281	86.4	13.6
GA IT	CNA441	Cessna Conquest	Turbo-prop	2	9,900	358	86.4	13.6
GA IT	CNA510	Cessna Mustang	Jet	2	8,645	70	86.4	13.6
GA IT	PA30	Piper PA-30	Piston	2	3,600	4,930	86.4	13.6
GA IT	GASEPV	1985 Variable Pitch	Piston	1	3,000	14,798	86.4	13.6
GA LOC	BEC58P	Baron 58P	Piston	2	6,100	12,101	95.0	5.0
GA LOC	CNA172	Cessna 172	Piston	1	2,450	36,304	95.0	5.0
GA HEL	B206L	Bell 206L	Turbine	2 Rotors	4,000	9,798	86.4	13.6
GA HEL	SC300C	Schweizer 300C	Piston	2 Rotors	2,050	19,597	95.0	5.0
GA HEL	R22	Robinson 22	Piston	2 Rotors	1,370	9,798	86.4	13.5
MIL	C130AD	Lockheed Hercules	Turbo-prop	4	175,000	228	95.0	5.0
MIL	T-38A	Talon T-38	Jet	2	12,093	228	95.0	5.0
Total						100,876		
MTOW – Maximum Takeoff Weight, GA IT - General Aviation Itinerant, GA LOC - General Aviation Local, GA HEL - General Aviation Helicopter, MIL - Military Sources: Michael Baker International, Inc., 2015.								

Table 3.9
Land Use Compatibility with Yearly Day-Night Average Sound Levels

Land Use	Yearly Day-Night Average Sound Level (DNL) in Decibels					
	Below 65	65-70	70-75	75-80	80-85	Over 85
Residential						
Residential, other than mobile homes and transient lodgings	Y	N(1)	N(1)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
Public Use						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Governmental services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail—building materials, hardware and farm equipment	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail trade—general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables and water recreation	Y	Y	25	30	N	N

Source: Federal Aviation Regulations Part 150, Airport Noise Compatibility Planning, Appendix "A," Table 1.

SLUCM=Standard Land Use Coding Manual.

Y (Yes)=Land Use and related structures compatible without restrictions.

N (No)=Land Use and related structures are not compatible and should be prohibited.

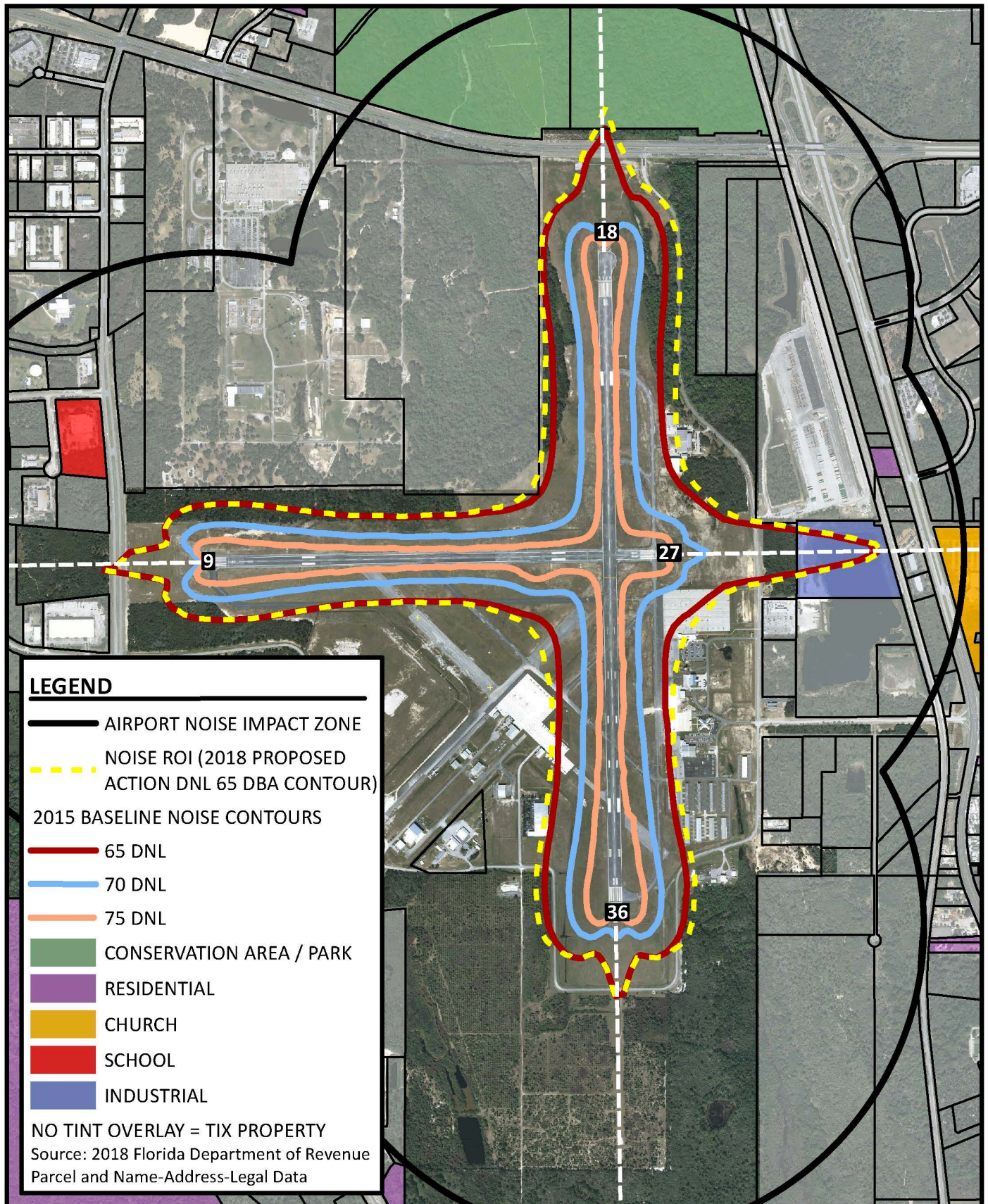
NLR=Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.

25, 30, or 35=Land use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structure.

Notes:

(1) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10 or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems. (2) Measures to achieve NLR 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low. (3) Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low. (4) Measures to achieve NLR 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal level is low. (5) Land use compatible provided special sound reinforcement systems are installed. (6) Residential buildings require an NLR of 25. (7) Residential buildings require an NLR of 30. (8) Residential buildings not permitted.

Figure 3-10 2015 Noise Contours and Noise ROI



which is also depicted in **Figure 3-10**, extends over the industrial parcel, but also encroaches upon 0.52 acre of the Enchanted Forest Sanctuary, a publicly owned conservation area located north of TIX. This section of the Sanctuary is vegetative hydric hammock and does not transect any of the eight existing hiking trails. Because this area is a U.S. Department of Transportation Section 4(f) property, it is discussed in greater detail in **Section 3.6** of this EA. **Table 3.11** summarizes the acres of property within the existing noise contours.

Table 3.10 Acres of Property Within 2015 Noise Contours					
Year	65+ DNL (Ac)	70+ DNL (Ac)	75+ DNL (Ac)	Conservation Area (Ac)	Industrial (Ac)
2015	414.05	205.03	95.56	0	6.25
Source: Michael Baker International, Inc., 2016.					

As shown in **Figure 3-10**, the existing noise exposure generated from aircraft activity at TIX is not incompatible with noise sensitive land uses.

3.13 SOCIOECONOMICS, ENVIRONMENTAL JUSTICE AND CHILDREN'S ENVIRONMENTAL HEALTH AND SAFETY RISKS

The socioeconomics ROI is based on the combined U.S. Census block groups (BGs) located along TIX's Runway 18-36 approach and departure air traffic patterns. Existing demographics within the ROI as they relate to socioeconomics, environmental justice, and children's environmental health and safety risks are provided in the following subsections.

3.13.1 Background

Socioeconomics

Among other requirements, Section 101(a) of NEPA notes the policy of the Federal government is to create and maintain conditions that fulfill the social needs of present and future American generations. Demographic data for the Socioeconomic ROI is included as the basis for evaluating potential future growth in the area. U.S. Census Bureau data was used at the BG level to further evaluate population and income within

the Socioeconomic ROI. A BG, which is a statistical division of a Census Tract (CT), is “the lowest-level geographic entity for which the U.S. Census Bureau tabulates sample data.”⁹⁴

Figure 3-11 depicts the Socioeconomic ROI, which is comprised of the following CTs and BGs:

- CT 612.01 BG 3,
- CT 612.01 BG 4,
- CT 612.02 BG 3,
- CT 621.04 BG 1,
- CT 621.08 BG 1, and
- CT 621.08 BG 3.

General demographic information about those living in these BGs is presented below (**Section 3.13.2**).

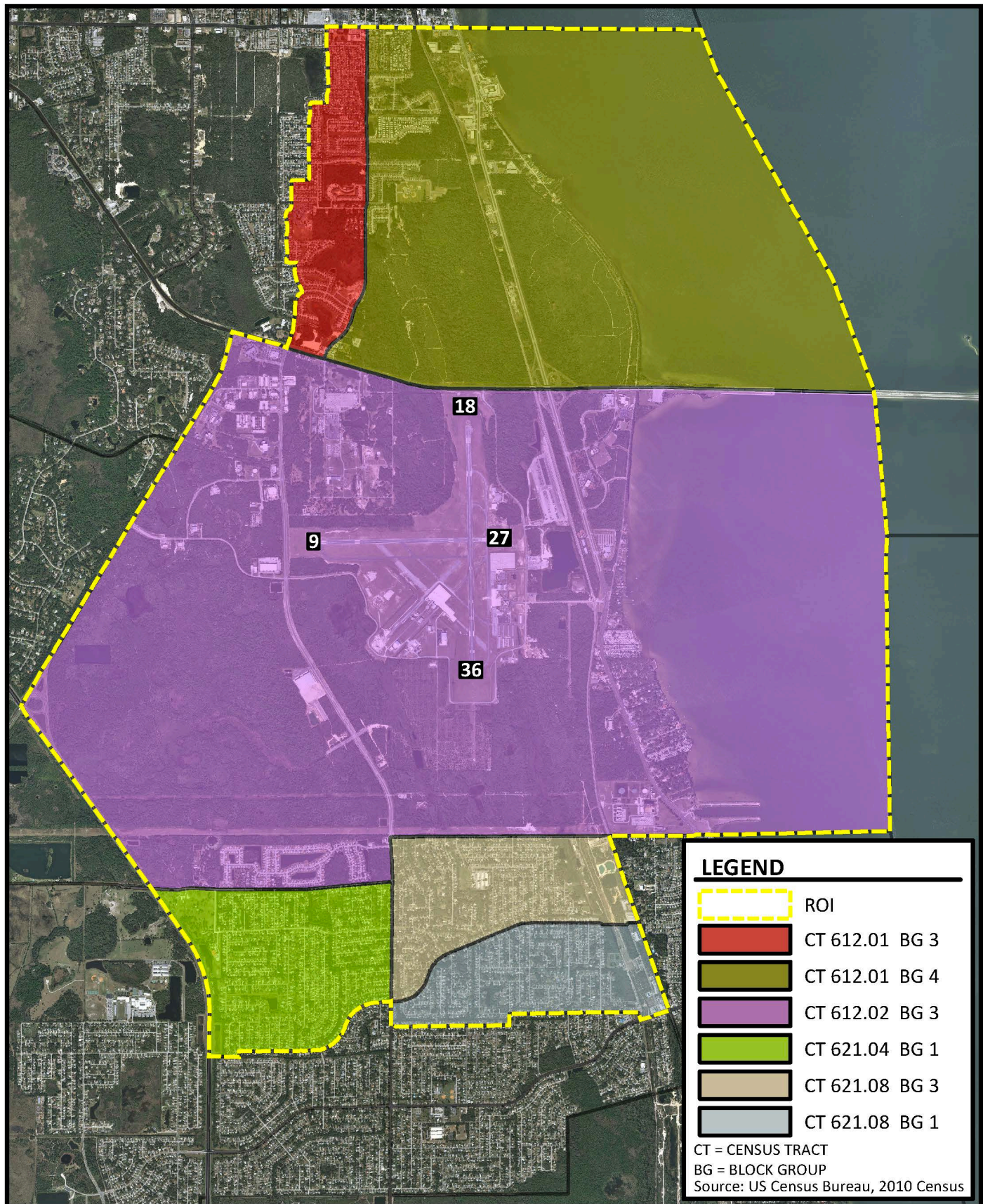
Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*⁹⁵, requires Federal agencies to analyze project effects relative to low-income and minority populations. Environmental justice analysis considers the potential of a Proposed Action and alternatives to cause disproportionate and adverse effects on low-income or minority populations. The analysis of environmental justice impacts and associated mitigation ensures that no low-income or minority population bears a disproportionate burden of effects resulting from the implementation of a preferred alternative. To help describe environmental justice, this EA relies on the instructions in FAA Order 1050.1F, Exhibit 4-1, which is consistent with DOT Order 5610.2(a), *Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. A minority population is comprised of Black, Asian-American, or American Indian and Alaskan Native, and Hispanics or Latinos. Each, several, or all of these groups may live in geographic proximity to one another or may be geographically scattered or transient (e.g., migrant workers). The CEQ definition of minority population states the minority population of an affected area exceeds 50 percent, or the minority population percentage of the affected area is meaningfully greater than the minority population percentage of the general population or other appropriate geographic analysis.

⁹⁴ United States Census Bureau, “Census Blocks and Block Groups,” <https://www2.census.gov/geo/pdfs/reference/GARM/Ch11GARM.pdf>, (March 5, 2019).

⁹⁵ Vol. 59, *Federal Register*, page 7629, February 1994.

Figure 3-11 2010 Census Block Groups



To help describe low income populations, this EA relies on two common measurements of poverty – poverty thresholds and poverty guidelines. Poverty thresholds are the original version of the Federal poverty measure and are updated each year by the U.S. Census Bureau. The thresholds are used mainly for statistical purposes – for instance, preparing estimates of the number of Americans in poverty each year.

Poverty guidelines are issued each year in the *Federal Register* by the Department of Health and Human Services. These guidelines are a simplification of the poverty thresholds that are used for administrative purposes including determining financial eligibility for certain Federal programs. **Table 3.12** lists the 2015 poverty guidelines for the 48 contiguous states and District of Columbia.

Table 3.11 2015 Poverty Guidelines¹	
Persons in family/household	Poverty Guideline
1	\$11,770
2	\$15,930
3	\$20,090
4	\$24,250
5	\$28,410
6	\$32,570
<small>1 – For the 48 contiguous states and the District of Columbia Source: United States Department of Health & Human Services, https://aspe.hhs.gov/2015-poverty-guidelines, (March 10, 2019).</small>	

Children’s Environmental Health and Safety Risks

Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*⁹⁶, requires Federal agencies to make child protection a high priority because children may be more susceptible to environmental effects than adults. Agencies are encouraged to ensure policies, programs, activities, and standards address disproportionate risks to children’s environmental health and safety.

⁹⁶ Vol. 62, *Federal Register*, page 19885, April 1997.

3.13.2 Affected Environment

Socioeconomics and Environmental Justice

Demographic Characteristics

As shown in **Table 3.13**, minority populations in the vicinity of the Socioeconomic ROI range from 11% (CT 621.08 BG 3) to 37% (CT 612.01 BG 4) of the total population. The minority percentages for all of the CTs except CT 612.01 BG 4 are lower than the percentage for the State of Florida (approximately 26%). Two of the CTs (CT 621.08 BG 1 and CT 621.08 BG 3) are lower than the percentage for Brevard County (18%) and Florida. The CT containing TIX (CT 612.02 BG 3) has a minority population higher than Brevard County but less than the State of Florida.

Table 3.12			
Comparison of Relevant Demographic Characteristics			
Area	Total Population	Percent White	Percent Minority
CT 612.01 BG 3	1,992	80	20
CT 612.01 BG 4	1,357	63	37
CT 612.02 BG 3	1,502	79	21
CT 621.04 BG 1	3,798	80	20
CT 621.08 BG 1	2,171	84	16
CT 621.08 BG 3	2,241	89	11
Brevard County	549,812	82	18
Florida	19,016,069	74	26
SOURCE: United States Census Bureau, American Community Survey 2008-2012, https://dataferrett.census.gov/LaunchDFA.html , (March 10, 2019).			

Economic Characteristics

Median household incomes within the Socioeconomic ROI range from \$39,276 to \$69,331 (**Table 3.14**). Two of the BGs (CT 612.01 BG 3, and CT 612.02 BG 3) have lower median household incomes than both the State of Florida (\$47,212) and Brevard County overall (\$48,483). CT 612.01 BG 4 has a lower median household income than the County and a

Table 3.13 Comparison of Relevant Economic Characteristics		
Area	Median Household Income (dollars)	Individuals Below Poverty Level (percentage)
CT 612.01 BG 3	39,798	14.5
CT 612.01 BG 4	48,438	6.2
CT 612.02 BG 3	39,276	24.5
CT 621.04 BG 1	61,583	7.6
CT 621.08 BG 1	69,331	4.1
CT 621.08 BG 3	55,219	12.9
Brevard County	48,483	12.5
Florida	47,212	9.2
SOURCE: United States Census Bureau, American Community Survey 2008-2012, https://dataferrett.census.gov/LaunchDFA.html , (March 10, 2019).		

higher median income than the State of Florida. The remaining three BGs have higher median household incomes than both the state and the county overall.

The percentage of the population living below the poverty level ranges from 4.1% of the population in CT 621.08 BG 1 to 24.5% of the population in CT 612.02 BG 3. For Brevard County and for the State of Florida, the percentage of the population living below the poverty level is 12.5% and 9.2%, respectively. The percentage of the population living below the poverty level is less than the percentage for Brevard County for three of the BGs (CT 612.01 BG 4, CT 621.04 BG 1, and CT 621.08 BG 1).

Community Services

Brevard County Fire Rescue provides fire suppression services for unincorporated Brevard County, and emergency/ambulance transport services for the entire Brevard County, a total response area of more than 1000 square miles.⁹⁷

Brevard County Fire Rescue operates 31 fire stations. The department consists of paid emergency response personnel, civilian employees, and fire and emergency medical reservists/volunteers.

⁹⁷ Brevard County, "Fire Rescue," <http://www.brevardcounty.us/FireRescue/About>, (March 5, 2019).

Brevard County Fire Rescue also operates 30 ambulance/transport units, 17 advanced life support fire engines, and 4 ladder trucks. All ambulance/transport units are staffed with two firefighter/paramedics or one firefighter/paramedic and one firefighter/EMT and all advanced life support engines are staffed with at least one firefighter/paramedic.⁹⁸

Children's Environmental Health and Safety Risks

The closest schools to TIX are Sculptor Charter School, Children's Montessori Academy, and Atlantis Elementary School. Sculptor Charter School, located at 1301 Armstrong Drive, is approximately 0.10-mile west of TIX. Children's Montessori Academy, located at 1300 Armstrong Drive, is approximately 0.20-mile west of TIX. Atlantis Elementary School, located at 7300 Briggs Avenue, is approximately 0.50-mile south of TIX.

3.14 WATER RESOURCES

3.14.1 Wetlands

3.14.1.1 Background

Wetlands are protected by multiple laws, regulations, and Executive Orders. Executive Order 11990, *Protection of Wetlands*, mandates that each federal agency take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural values.⁹⁹ The CWA regulates discharges into waters of the United States, which include wetlands. Under Section 404 of the CWA, USACE regulates dredging and filling activities within jurisdictional wetlands. Furthermore, under Section 401 of the CWA, projects must receive state water quality certification to ensure the project will not violate the state's water quality standards. This water quality certification is required before USACE can issue a dredge and fill permit under Section 404.

The ROI for wetlands is the construction ROI.

3.14.1.2 Affected Environment

Wetlands within the construction ROI were identified using available aerial photography, the SJRWMD FLUCS mapping (see **Section 3.3.2, Affected Environment**, for FLUCS descriptions), SJRWMD LIDAR data (LiDAR, a word formed from the words light and radar, refers to a remote sensing technique that analyzes reflected laser light to determine characteristics such as ground elevation) and field wetland delineation. Field wetland delineations were conducted on October 29, 2013, and May 27, 2014. The field wetland

⁹⁸ *Ibid.*

⁹⁹ Vol 42, *Federal Register*, page 26961, May 1977.

delineations followed the three-parameter method of the USACE, which uses prevalence of hydrophytic (wetland adapted) vegetation, evidence of wetland hydrology, and presence of hydric soils (determined using hand-drilled soil auger samples) to establish the wetland boundary. Based on these sources of information, a total of 2.2 acres of wetlands occur within the construction ROI (**Figure 3-12**). Functions of wetlands in the construction ROI likely include natural storage and filtration of stormwater runoff, and to a lesser extent wildlife habitat. Habitat functions are somewhat limited because the wetlands within the construction ROI are located in the middle of an area of degraded disturbed habitat within the former citrus grove south of Perimeter Road. The wetlands likely provide a source of water for wildlife during times when they are inundated. No wildlife were observed using these areas during the wetland delineation.

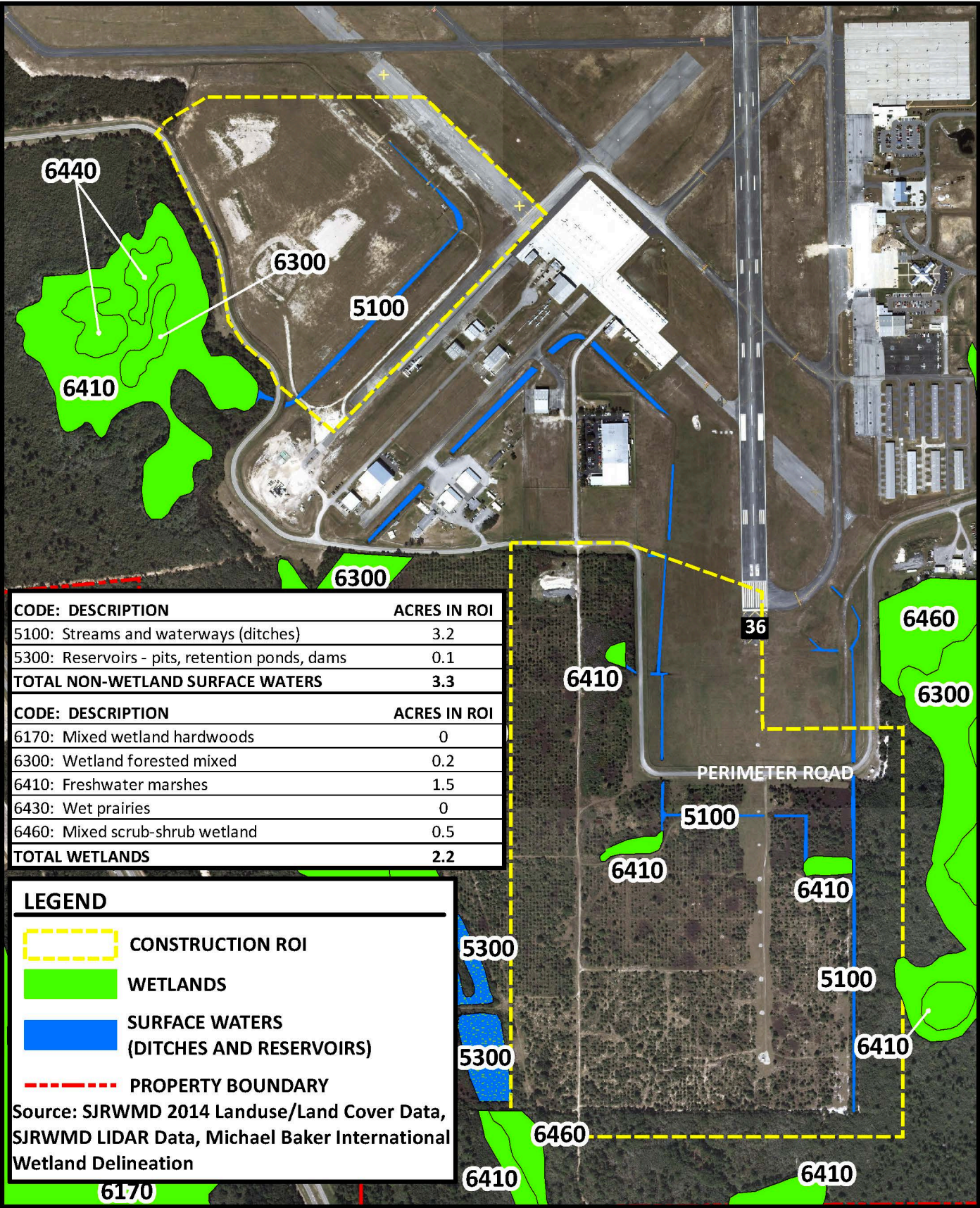
Wetland Cover Types in ROI

Wetland Forested Mixed is mapped within 0.2 acre in the southeastern portion of the construction ROI. This wetland type is typically dominated by a canopy that includes a mix of hardwood species such as red maple (*Acer rubrum*), sweet bay (*Magnolia virginiana*), swamp bay (*Persea palustris*), laurel oak (*Quercus laurifolia*), and black gum (*Nyssa sylvatica biflora*), as well as conifers such as slash pine (*Pinus elliottii*). This wetland cover type typically exhibits seasonal soil saturation.

Freshwater Marshes that are dominated by herbaceous species are mapped for 1.5 acres of the construction ROI. Areas mapped as this wetland cover type are small wetlands that are scattered through the portion of the construction ROI south of Perimeter Road. Dominant species include maidencane (*Panicum hemitomon*), sawgrass (*Cladium jamaicense*), redroot (*Lachnanthes caroliniana*), and cattail (*Typha latifolia*). Freshwater marshes are typically inundated for extended periods during the year.

Mixed Scrub-Shrub Wetlands are mapped for 0.5 acre in the southwestern portion of the construction ROI. This wetland cover type exhibits hydrology characterized by seasonally saturated soils. Dominant species within this wetland cover type include groundsel tree (*Baccharis halimifolia*), Brazilian pepper, wax myrtle, coastal plain willow (*Salix caroliniana*) and fetterbush.

Figure 3-12 Wetlands and Surface Waters



3.14.2 Floodplains

3.14.2.1 Background

The Federal Emergency Management Agency (FEMA) defines floodplains as “any land area susceptible to being inundated by floodwaters from any source.”¹⁰⁰ The FEMA-designated 100-year floodplain boundary delineates a flood elevation that has a one percent chance of being equaled or exceeded in any given year.

EO 11988, *Floodplain Management*, requires federal agencies to take action to reduce the risk of flood damage; minimize the impacts of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains. Federal agencies are directed to consider the proximity of their actions to or location within floodplains. DOT has implemented EO 11988 through policies and procedures documented in DOT Order 5650.2, *Floodplain Management and Protection*.

The National Flood Insurance Act established the National Flood Insurance Program, which is a voluntary floodplain management program for local communities. The National Flood Insurance Program is based on a mutual agreement between the Federal Government and communities. Communities that participate agree to regulate floodplain development according to certain criteria and standards.

The floodplain ROI is defined as the construction ROI.

3.14.2.2 Affected Environment

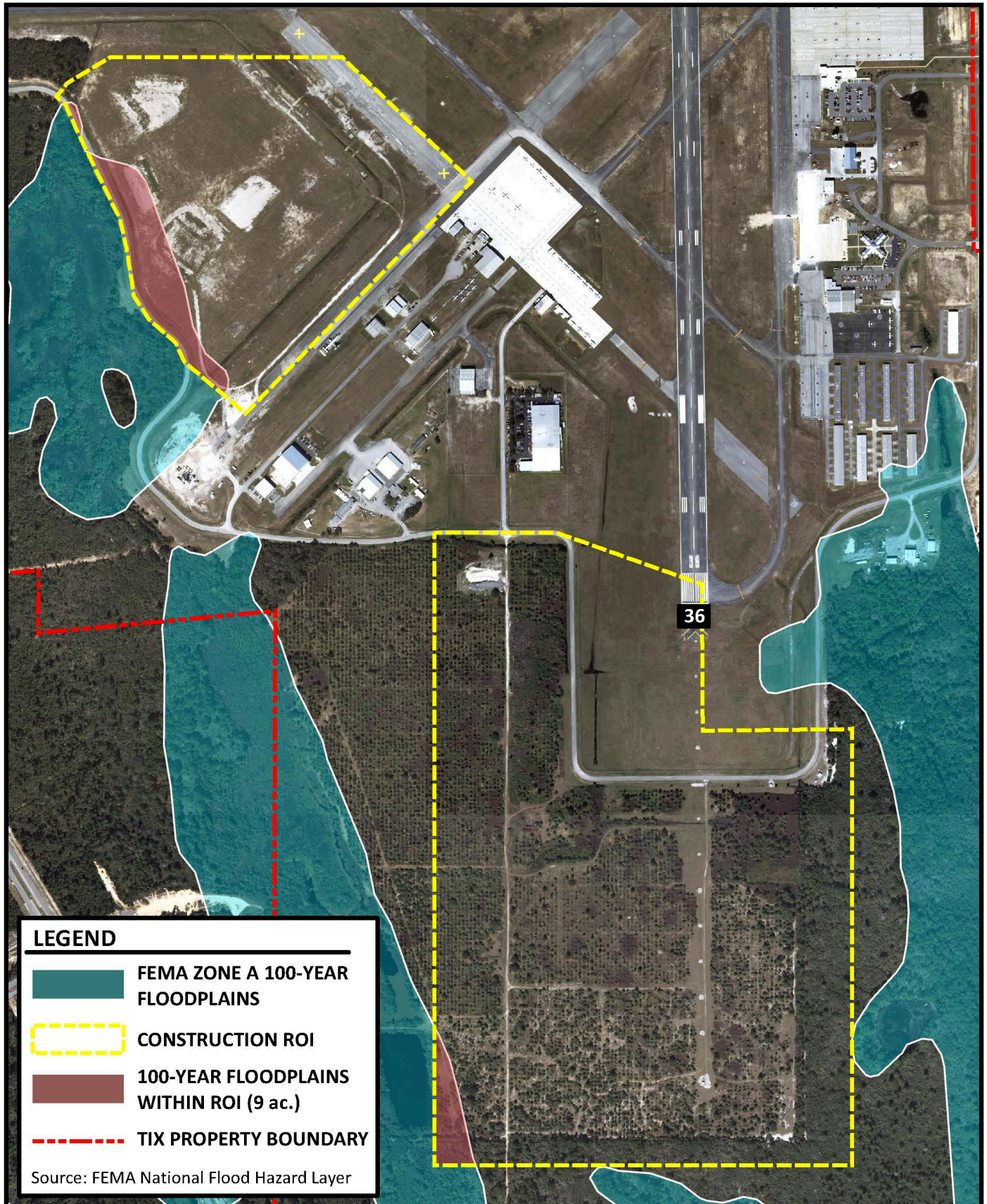
The potential presence of 100-year floodplains was evaluated by reviewing the FEMA’s National Flood Hazard Layer, which incorporates data from the FEMA’s Flood Insurance Maps.¹⁰¹ Based on this data, approximately 9 acres of “Zone A” 100-year floodplains occur within the construction ROI. These flood hazard areas occur in 3 different locations throughout the ROI (**Figure 3-13**). Zone A floodplains are areas that have been delineated using approximate methodologies. Typically, for Zone A floodplains, no detailed hydraulic analysis has been performed by FEMA, therefore the base flood elevations have not been determined; however, floodplain management standards still apply.¹⁰²

¹⁰⁰ FEMA, “Definitions,” <https://www.fema.gov/national-flood-insurance-program/definitions>, August 21, 2018 (March 5, 2019).

¹⁰¹ FEMA, “GIS Web Services for the FEMA National Flood Hazard Layer,” <https://hazards.fema.gov/femaportal/wps/portal/NFHLWMS>, March 5, 2019 (March 5, 2019).

¹⁰² FEMA, Zone A Definition/Description, <https://www.fema.gov/zone>, September 14, 2018 (March 5, 2019).

Figure 3-13 FEMA 100-Year Floodplains



3.14.3 Surface Waters

3.14.3.1 Background

The CWA is the primary law that seeks to ensure water quality in the United States. The CWA enabled the establishment of water quality standards, surface water use classifications, state reporting of impairment of water quality in streams and open water bodies [303(d) listing], development of programs to remediate such impairment (total maximum daily loads), and the requirement of water quality certification for federally permitted or licensed activities under Section 401 of the CWA. Under Section 402 of the CWA, the NPDES permitting system was established to regulate point source discharges, such as releases from waste water treatment plants and industrial facilities (including airports) and discharges such as mobilized sediments and erosion from construction sites. Section 402 also resulted in the establishment of the requirement that facilities that store oil and oil-based products have Spill Prevention Control and Countermeasures Plans to minimize the likelihood or severity of water quality impacts in the event of a spill. Direct physical impacts to waters of the U.S., including surface waters, are also subject to permitting by USACE under Section 404 of the CWA as well as Florida's Environmental Resource Permitting requirements.

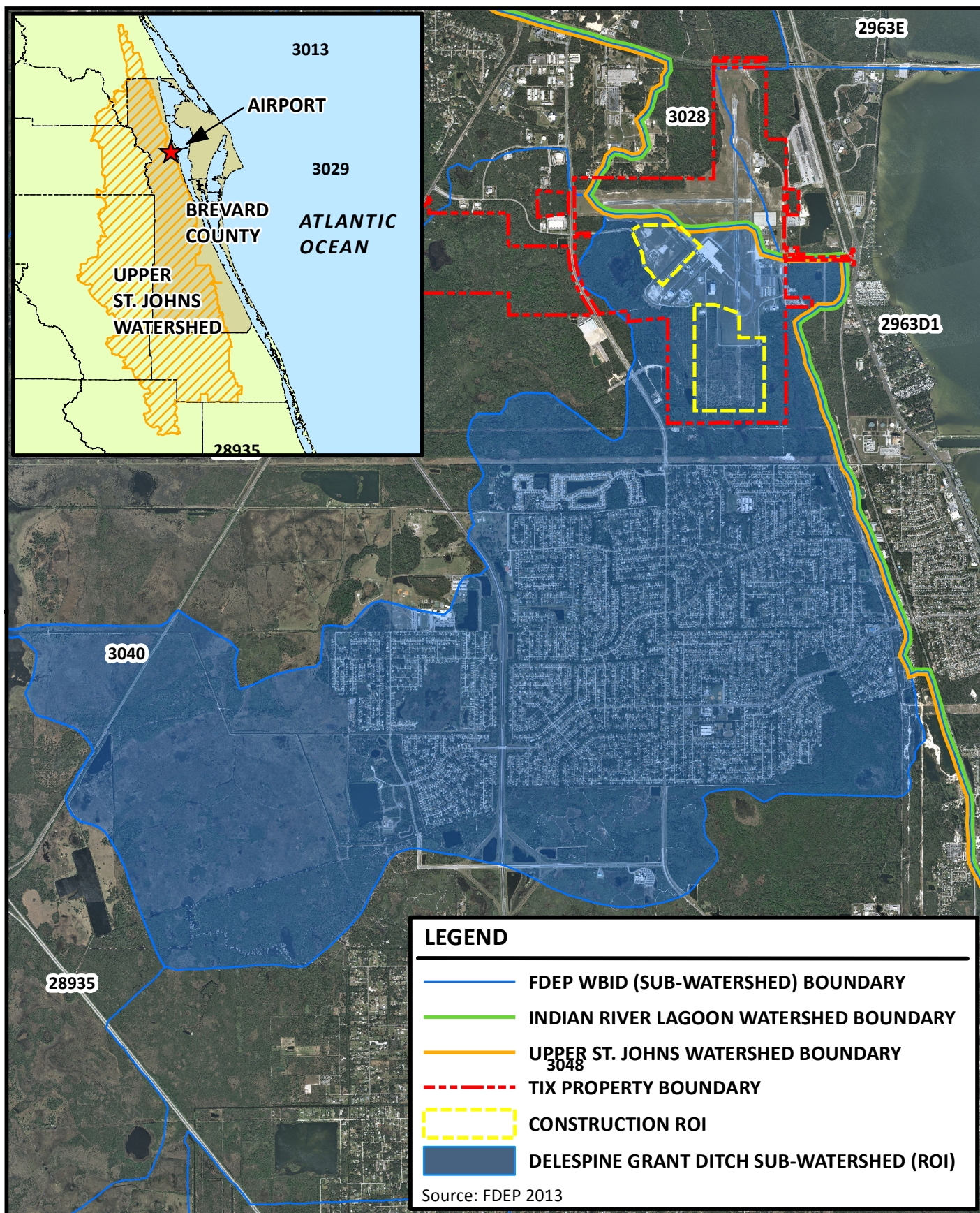
The Fish and Wildlife Coordination Act, 16 U.S.C. Section 661-667, requires that federal action agencies coordinate with the USFWS concerning wildlife conservation when a federal action will affect or result in the control or modification of the water of a stream or other water body.

The Rivers and Harbors Act, 33 U.S.C. Section 401 and 403, established protections for the navigable waters of the United States used for commerce. Actions that may affect navigability may require a Section 10 permit from USACE or a Section 9 bridge permit from the U.S. Coast Guard.

3.14.3.2 Affected Environment

The ROI for surface water quality impacts is the boundary of the Delespine Grant Ditch sub-watershed, FDEP water body identification number 3040. This is the subwatershed that surrounds and receives runoff from the construction area. The Delespine Grant Ditch sub-watershed is situated within the FDEP-delineated Upper St. Johns Watershed, and the main channel of the St. Johns River is located approximately 4 miles west of the surface waters ROI (**Figure 3-14**). Direct physical impacts to surface waters are evaluated within the construction ROI.

Figure 3-14 Surface Water Quality Region of Influence



Under Section 303(d) of the CWA, states are required to establish use classifications for surface waters within their boundaries and submit to the USEPA a list (the 303(d) list) of surface waters which are not supporting their designated use classification due to water quality impairment such as elevated levels of pollutants, excess nutrients, elevated levels of bacteria, or low levels of dissolved oxygen. Surface waters within the Delespine Grant Ditch sub-watershed are designated as Class III waters. Class III waters, by definition, support populations of fish that can be safely consumed and should be suitable for recreational use and propagation and maintenance of a healthy, well-balanced population of fish and wildlife. No surface waters within the Delespine Grant Ditch sub-watershed are 303(d) listed as impaired.

As depicted on **Figure 3-12**, surface waters within the construction ROI include a 0.1-acre portion of a pond that is located in the southwestern corner of the construction ROI and 3.2 acres of wet ditches within the construction ROI that would potentially be considered jurisdictional waters of the U.S. by the USACE. These ditches include ditches that are part of the stormwater drainage system of the airfield as well as additional ditches within the former citrus grove south of Perimeter Road. No navigable waters of the United States or natural stream channels are located in the construction ROI.

3.14.4 Groundwater

3.14.4.1 Background

The Safe Drinking Water Act (42 U.S.C. Section 300.f) prohibits federal agency actions that would contaminate a sole source aquifer (an aquifer that provides at least 50 percent of the drinking water for the area overlying the aquifer).

3.14.4.2 Affected Environment

TIX is situated above two aquifer systems, the surficial aquifer and the underlying Floridan aquifer. An aquifer is an underground layer of porous rock or gravel that holds groundwater, like a natural storage tank. Brevard county draws water from both the Floridan Aquifer and the surficial aquifer to provide drinking water.¹⁰³

Water quality in the underlying aquifers is sufficient to provide potable water for public consumption and other uses, but aquifers in Florida are generally considered to be vulnerable to contamination due to the high water table, the high porosity of the materials overlying the aquifers and the high degree of development within the state. Some potential sources of pollutants that can affect the groundwater quality of the aquifers include underground storage tanks containing petroleum products, agricultural

¹⁰³ Brevard County Utility Services Department, "Drinking Water Information," <http://www.brevardcounty.us/UtilityServices/FAQ>, (March 5, 2019).

chemicals that percolate into soils with precipitation, landfill leachate, and septic systems. Available potable water quantity is also of concern due to increasing populations and resultant increasing withdrawal of water from the aquifer.

The ROI for groundwater is the construction ROI. The construction ROI was chosen because this is the area within which percolating surface runoff from the construction area associated with the alternatives under consideration has the potential of reaching the underlying aquifers. According to SJRWMD groundwater recharge mapping, the majority of the construction ROI is within an aquifer recharge area with recharge rates ranging from 4 to 8 inches per year. Based on the boundaries of sole source aquifers that were obtained from USEPA's website, the construction ROI does not overlie or provide recharge for any sole source aquifers.¹⁰⁴ The nearest sole source aquifer is over 11 miles northwest of the construction ROI.

¹⁰⁴ USEPA, "Map of Sole Source Aquifer Locations," <https://www.epa.gov/dwssa/map-sole-source-aquifer-locations>, September 8, 2017 (March 5, 2019).

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter presents the environmental consequences associated with the Proposed Action and No Action Alternative. In determining whether a potential impact would be significant under NEPA, the analysis in this chapter considers the FAA's significance thresholds and factors to consider presented in FAA Order 1050.1F, Exhibit 4 1. For those impact categories for which the FAA has not identified a significance threshold, but has identified the factors to consider, note that the factors are not intended to be thresholds. If these factors exist, there is not necessarily a significant impact; rather, the FAA must evaluate these factors in light of their context and intensity to determine if there are significant impacts.

4.2 AIR QUALITY

Significance Threshold

Impacts would be significant if the action would cause pollutant concentrations to exceed one or more of the NAAQS, as established by USEPA under the Clean Air Act, for any of the time periods analyzed, or would increase the frequency or severity of any such existing violations.

Environmental Consequences

Recent air quality assessments of potential RLV operations in FAA NEPA documentation were used for analysis within this EA. The air quality emissions analyses presented in the 2014 Midland International Air and Space Port Final EA and 2015 Houston Spaceport EA were used to disclose the potential emissions from Concept X, Y, and Z RLV operations.

As described in **Section 3.2**, Brevard County is in attainment for all six criteria pollutants. The following subsections describe the potential direct and indirect air quality impacts of the No Action Alternative and the Proposed Action.

No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to TCAA for the operation of a launch site at TIX. The No Action Alternative would not introduce RLV operations at TIX. It should be noted that ongoing aviation growth at TIX would continue and that future operational conditions could differ from existing conditions. Ongoing conventional aircraft operations and surface vehicle traffic from users of TIX would also continue and emissions from those operations would occur. However, there would be no impacts to air quality beyond those already occurring or those projected to occur as a result of normal growth due to the No Action Alternative.

Proposed Action

Short-term effects on ambient air quality could occur during construction portions of the Proposed Action.

Operation of RLVs would cause criteria air pollutant (CAP) emissions within the troposphere and stratosphere. CAP and HAP emissions from support equipment operations would also occur. CAP and HAP emissions occurring above the local atmospheric mixing height (nominally 3,000 feet) would not reach ground level. Accordingly, these emissions are not addressed in this EA. **Table 4.1** summarizes the annual CAP emissions resulting from the forecast of RLV operations in years of the launch site operator license (2020 to 2025) when up to 50 operations could occur per year and compares them to the EPA's most recent emissions data for Brevard County.

LOX is liquid below -298 degrees F and is stored in insulated tanks in the RLV. LOX when mixed and ignited produces water vapor as a combustion product. Should there be a need to vent LOX while in flight, this would most likely occur at a minimum altitude of 1,067 meters (3,500 feet). No documented effects of vented LOX could be found in literature. Because of the elevation where LOX would most likely be vented and the temperature difference, the LOX would most likely evaporate right after it is released.

Implementation of the Proposed Action may also have indirect air quality impacts. An RLV operator based at the Airport could have a direct employment of approximately 20 to 40 people. This would lead to an increase in vehicle miles traveled to and from the Airport. Assuming an RLV operator could have direct employment of 20 to 40 full time employees, there could be an increase of approximately 20 to 40 round trips per day to and from the Airport. In addition, propellant delivery would result in an increase in truck trips to and from the Airport. The estimated number of employees is subject to change based on the number and type of operations. In addition, propellant delivery would result in an increase in truck trips to and from the Airport. In addition, delivery trucks have the potential to store a greater amount of propellant

Table 4.1 Estimated Annual Emissions by RLV Type (Below 3,000 Feet)						
Vehicle	Annual Emission Loads (Tons) ¹					
	CO	NO _x	PM ₁₀	PM _{2.5}	SO _x	VOC
Concept X	0.4	0.1	<0.1	<0.1	<0.1	<0.1
Concept Y	10.3	0.0	0.0	0.0	0.0	0.0
Concept Z	0.3	0.1	<0.1	<0.1	<0.1	0.1
Total ³	11.0	0.2	<0.1	<0.1	<0.1	0.1
Brevard County 2014²	110,030	15,604	15,293	5,775	1,307	20,528
Notes: ¹ Previous air quality assessments of potential RLV operations were used to support the analysis in this EA. Air quality analysis presented in the Midland International Air and Space Port Final EA (2014), is used to quantify emissions from the Concept Y RLV. The Midland 2014 Final EA considered a total of 520 annual launches of the Concept Y RLV. However, for this EA, a total of 50 launches of the Concept Y RLV are considered for this air quality analysis. Since this is significantly less than the 520 launches considered in the Midland 2014 Final EA, the annual operation emission estimates are divided by 520 in order to determine the approximate emissions per launch. The emissions per launch are then multiplied by 50 to estimate the Concept Y RLV annual emissions per year. Data from the Houston Spaceport Final EA (2015) was used to estimate Concept X and Z RLV emissions. This analysis considers 50 launches of each RLV each year when calculating potential emissions. This provides a conservative emissions analysis. For the analysis, estimated annual emissions would be the same for each of the five years of the license 2020 to 2025. ² Total annual tons per year, per major tier, for most recent year (2014) available from the EPA: https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-data , January 30, 2019 (March 6, 2019). ³ Totals reflect rounding. Sources: 2014 Midland International Air and Space Port Final EA and 2015 Houston Spaceport EA.						

than what may be needed per launch, the maximum possible number of propellant deliveries would occur if on-site storage tanks were not used and separate truck trips for fuel and for oxidizer were used to supply each of the 50 launches, for a total of 100 truck round trips per year. The actual number of truck trips expected to support the Proposed Action at TIX would be lower. The increase in vehicle miles travelled by employees and the delivery of propellant would not significantly affect the area's air quality or the County's attainment status for any of the six criteria pollutants.

When compared to a No Action Alternative, the Proposed Action's emissions from RLV operations at TIX would not result in a significant air quality impact.

Temporary, construction-related air emissions, including GHG emissions, would primarily be associated with the exhaust from heavy equipment (i.e., backhoes, bulldozers, graders, etc.), delivery trucks and construction worker vehicles getting to and from the site; and fugitive PM (dust) from earthwork/grading, material handling, equipment movement on unpaved areas, and storage/transfer of raw materials.

The use of Best Management Practices would minimize construction-related air emission impacts. As a result, the temporary construction-related air quality impacts, including a temporary increase in GHG emissions, would not be significant.

4.3 BIOLOGICAL RESOURCES

Significance Threshold

Biological resource impacts would be significant if the USFWS or NMFS determines the action would be likely to jeopardize the continued existence of a federally listed threatened or endangered species or would result in the destruction or adverse modification of federally designated critical habitat. The FAA has not established a significance threshold for unlisted species. Factors to consider when assessing whether significant impacts to unlisted species would occur include:

- A long-term permanent loss of unlisted plant or wildlife species i.e., extirpation of the species from a large project area (e.g., a new commercial service airport);
- Adverse impacts to special-status species (e.g., state species of concern, species proposed for listing, migratory birds, bald and golden eagles) or their habitats;
- Substantial loss, reduction, degradation, disturbance, or fragmentation of native species' habitats or their populations;
- Adverse impacts on a species' reproductive success rates, natural mortality rates, non-natural mortality (e.g., road kills and hunting), or the ability to sustain the minimum population levels required for population maintenance.

Environmental Consequences

No Action Alternative

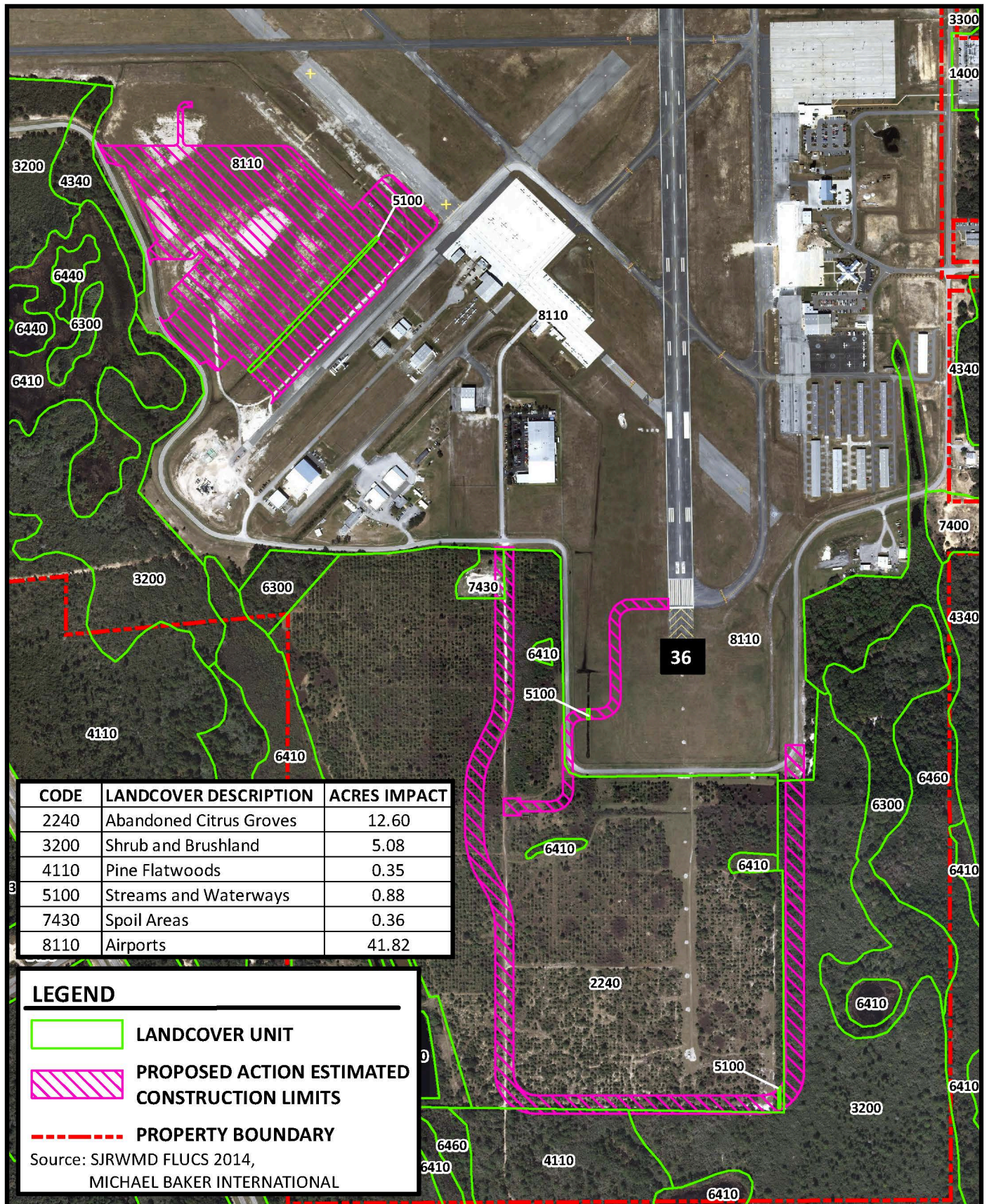
Under the No Action Alternative, no new spaceport infrastructure would be constructed at TIX and no RLV operations would occur from TIX. Any existing impacts (e.g., noise-related disturbances to wildlife at or near TIX) to biological resources from airport operations would continue. The No Action Alternative would not result in new impacts to biological resources.

Proposed Action

Upland Habitat Impacts

For the purposes of this EA, habitat impacts from the Proposed Action are described in terms of FLUCS categories (**Figure 4-1**). The majority of construction would occur on disturbed land (i.e., land designated as "airports"). Construction would impact a total of 41.82 acres of upland habitat

Figure 4-1 Impacted Landcover Types



described as “airports.” This land cover category would be impacted from the development of a new hangar that would be used for RLV manufacturing and hybrid fuel storage, parking lots, access roads, an apron, a stormwater pond, the rocket fuel storage area, the oxidizer storage area, a portion of the proposed Perimeter Road relocation, and a portion of the proposed new taxiway (refer to **Figure 2-1b**). This area contains bahia grass and common turfgrass weeds. For the remainder of the relocated section of the Perimeter Road, the remainder of the new taxiway, and for the oxidizer loading area, construction would impact 12.60 acres of shrub habitat within the abandoned citrus grove. Additionally, a 0.36-acre portion of a spoil area, 0.35 acre of pine flatwoods, and 5.08 acres of shrub and brushland habitat would be impacted from the relocation of the Perimeter Road. Impacts include permanent removal of vegetation for road construction.

None of the habitats impacted by construction are unique or rare habitat types. Most of the upland habitats that would be impacted have been altered by man. The only natural habitats that would be impacted are the pine flatwoods and shrub and brushland habitats; however, even these habitats have been altered by man due to exclusion/suppression of fire. These habitat types are not uncommon in the region.

Construction activities have the potential to spread invasive plants if construction equipment introduces invasive plant seeds or plant material, or the soil stabilization seed mix is contaminated with seed from invasive species. To minimize the spread of invasive plants, the contractor would be required to provide assurances the equipment is clean and free of foreign plant material when it is brought to the site. The construction specifications would require that the seed mix to be used for soil stabilization or sodding of the construction site is free of invasive plant materials. Therefore, no spread of invasive plants is anticipated.

In summary, the Proposed Action would not result in significant impacts on plants.

Impacts to Wildlife without Special Protection Status

Some wildlife (e.g., small mammals or reptiles) would likely be displaced from the construction ROI, particularly the abandoned citrus grove and the pine flatwoods and shrub and brushland habitat where the Perimeter Road would be constructed. As shown on **Figure 2-1a**, a large tract of undeveloped land is located adjacent to the west side of the abandoned citrus grove. This undeveloped land would not be impacted by construction and would provide habitat for displaced wildlife. No substantial mortality of animals is expected from construction, due to the ability of the species using the area to disperse. Individual animals may be startled during RLV takeoff. Due to the low number of spacecraft operations that are proposed (up to 50 per year), bird mortalities resulting from collisions with RLVs is expected to be very low. No significant impacts on general wildlife species are expected.

Impacts to ESA-Listed Species

The FAA sent an ESA section 7 consultation letter to the USFWS on March 18, 2016 (see **Appendix B**). In the letter, the FAA discussed the potential effects to ESA-listed species, including those listed in **Table 3.3**. The FAA determined the Proposed Action would have no effect on any ESA-listed species, except the eastern indigo snake. The FAA determined the Proposed Action “may affect, but is not likely to adversely affect” the eastern indigo snake. The USFWS concurred with the FAA’s effect determination for the eastern indigo snake on April 25, 2016. Therefore, the Proposed Action would not result in significant impacts on ESA-listed species. Refer to **Appendix B** for the effects analysis on ESA-listed species, including terrestrial and aquatic species.

Impacts to Bald Eagles

The nearest known bald eagle nests are approximately 0.8 mile southeast, 0.85 mile southwest, and 2.56 mile north of the construction ROI. At those distances, nesting eagles would not be disturbed by construction activities. Both the FWC and the USFWS follow the USFWS’ 2007 National Bald Eagle Management Guidelines to evaluate potential impacts from construction projects.¹ For roadway construction not visible from a nest site, the guidelines recommend that construction not be located any closer than 330 feet to the nest. This would also apply to construction of a taxiway. For building construction of three or more stories (which would be of similar height to the proposed hangar/RLV manufacturing facility), the USFWS recommends that construction not be located any closer than 660 feet from the nest. All of the documented nests in the vicinity of TIX are greater than 3,700 feet from the construction ROI. Therefore, no impacts to bald eagles from construction are anticipated.

As discussed in **Section 4.12**, operational noise would have minimal impact on the existing ambient noise conditions at and around TIX. Additionally, the USFWS recommends that fixed wing aircraft avoid operating at distances within 1,000 feet of a nest during nesting season.² The operational ROI, which was developed by buffering the flight tracks for the RLVs, is over 2,200 feet from the nearest documented eagle nest for the portion of the ROI on the west side of the Indian River. For the portion of ROI over Merritt Island, the altitude at which the RLVs would be operating would place them much more than 1,000 feet from eagle nests on Merritt Island. Therefore, RLV launches would not disturb nesting bald eagles.

¹ USFWS, “National Bald Eagle Management Guidelines,” <https://www.fws.gov/northeast/ecologicalservices/pdf/NationalBaldEagleManagementGuidelines.pdf>, May 2007, (March 5, 2019).

² *Ibid.*

Impacts to Migratory Birds

Migratory birds could nest within the construction ROI. If construction is conducted during the April 1 to August 31 breeding season, pre-construction nesting surveys would be conducted. If a nest is found, construction would not commence in the area around the nest until the nest is no longer active.

Potential impacts to migratory birds from operations are difficult to quantify. It is possible that a migratory bird could strike an RLV during operation, as happens occasionally with other aircraft. At TIX, during the period from 2001 to July 2015, a total of 15 bird strikes have been reported involving aircraft. During that same period, over 2.1 million aircraft operations have occurred at the airport, so approximately 0.0007 percent of aircraft operations have experienced a reported bird strike. Reported strikes are therefore occurring at a rate of about one in every 142,857 aircraft operations at TIX. Because a maximum of 250 total RLV operations could occur over the 5-year term of the launch site operator license, the chances that a bird strike would occur during any launch is low. The Proposed Action would not result in significant impacts on migratory birds.

Impacts to Marine Mammals and Fish

The operational ROI extends over habitats for marine mammals and fish in the Indian River and the Atlantic Ocean. Operational noise may be perceptible by marine mammals and fish in these areas. Sonic booms over the Atlantic Ocean from the Proposed Action would generate overpressures of 0.9 psf (or 128 dB), which is similar to a clap of thunder. Given that little sound is transmitted between the air-water interface, operational noise, including sonic booms, would have no effect on marine mammals and fish.

State-Protected Species

Potential impacts to state-protected species are addressed in the following paragraphs. The discussion focuses on potential construction-related impacts. RLV operations are not expected to affect state-protected species, because operations would have a minimal impact on the existing ambient noise levels at and around TIX.

Wading Birds

No wetlands would be affected by the Proposed Action (see **Section 4.14**). The construction of some infrastructure, including the apron and oxidizer storage area, the relocated portion of Perimeter Road, and the taxiway to the oxidizer loading area, would impact a total of 0.88 acre of ditches that may represent marginally suitable foraging habitat for wading birds. The suitability of these ditches for foraging by wading birds is somewhat limited based on the results of the general protected species surveys conducted at TIX in October 2014 and May 2015, and because TIX implements wildlife hazard management measures to discourage wading birds and other wildlife from using airport property. The ditches south of Perimeter Road that would be impacted

appear to remain dry for the majority of the year. The larger ditch in the area of the proposed spaceport operator complex does appear to remain wet for extended periods, but this ditch has relatively high, steep banks. Such conditions may discourage wading birds from foraging, as birds are sometimes reluctant to forage within ditches that obscure visibility and restrict their ability to detect approaching predators. As noted above, operational noise would have a minimal impact on the ambient noise levels at TIX. Therefore, the Proposed Action would not significantly affect wading birds.

Florida Burrowing Owl

The only documented burrowing owl occurrence in Brevard County is over 16 miles south of the construction ROI. The possibility exists that dispersing owls could establish one or more territories at TIX, but the Proposed Action would only affect a small portion of the available habitat. If burrowing owls are discovered at the site prior to development, necessary permits would be obtained so that the burrow(s) could be impacted without harming the owls. No adverse effects to the Florida burrowing owl are anticipated.

Florida Sandhill Crane

Because the entire grassed airfield provides suitable foraging habitat for the Florida sandhill crane, construction would have negligible impact to the overall availability of suitable foraging habitat. Abundant foraging habitat would still be available on TIX property and in the surrounding region following construction. TIX implements wildlife hazard management measures to discourage Florida sandhill cranes and other wildlife from using airport property. No adverse effects to the Florida sandhill crane are anticipated.

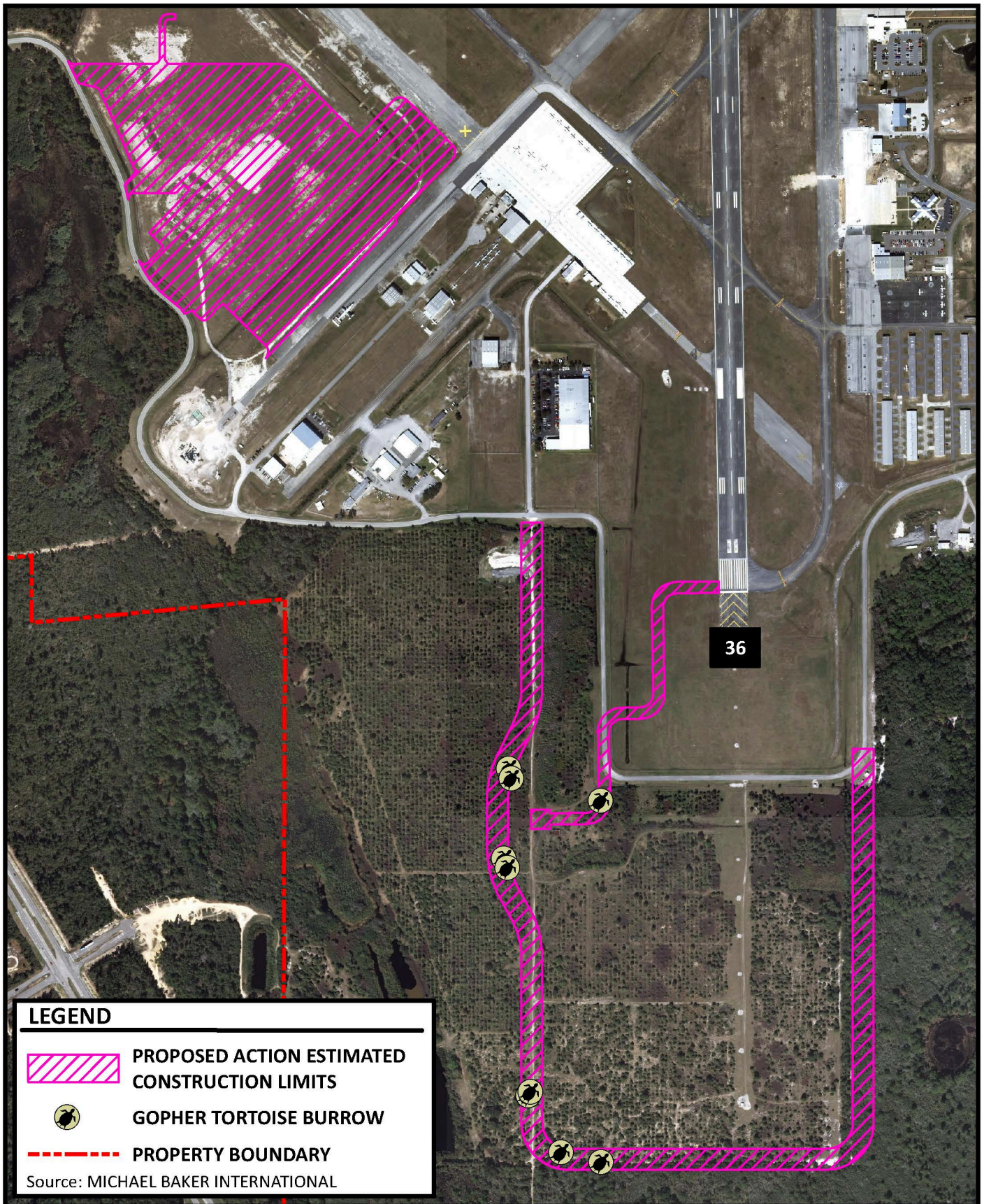
Other State-Protected Bird Species

For several state-protected bird species, including the American oystercatcher, roseate spoonbill, black skimmer, and least tern, construction would not result in direct impacts to their habitats. Therefore, the Proposed Action would not affect these species.

Gopher Tortoise

During the general protected species survey conducted for the EA, a total of eight gopher tortoise burrows were observed within the area that would be impacted by the relocation of Perimeter Road and the construction of the new taxiway (refer to **Figure 4-2**). The gopher tortoise is protected by regulations of the State of Florida, and, as such, a gopher tortoise conservation permit would be obtained, gopher tortoise burrows would be excavated, and tortoises found would be relocated prior to construction in accordance with the FWC permit. As a result, no take of gopher tortoises would occur because of construction activities. Therefore, the Proposed Action would not result in significant impacts on the gopher tortoise.

Figure 4-2 Identified Gopher Tortoise Burrow Impacts



Florida Pine Snake

Construction activities have the potential to impact Florida pine snake if individuals of this species are present within the construction ROI. If Florida pine snakes are found as part of gopher tortoise burrow excavation, they would be relocated to another nearby area of suitable habitat on TIX property outside the construction ROI. No significant impacts to the Florida pine snake are anticipated.

Potential Impacts from a Launch Failure

In the event of a launch failure, habitats and wildlife within the ROIs may be impacted by falling debris, fire, and associated noise. However, spread of fire would be minimized by emergency response procedures as described in the Airport Certification Manual (ACM) for TIX. The ACM contains provision for emergency response on- or off-airport. In addition, the probability of launch failure is low, so it is unlikely that falling debris would strike wildlife, particularly ESA-listed and state-listed species, which are uncommon within the ROIs.

Conclusion

Based on the discussion above, there would be no significant impacts to biological resources. As discussed in the USFWS consultation letter (**Appendix B**), implementation of the “*Standard Protection Measures for the Eastern Indigo Snake*” would ensure no adverse effects to this species. Pre-construction nest surveys would be required to avoid migratory bird impacts, if construction occurs during the nesting season. Gopher tortoise burrows would be excavated and tortoises relocated under a Gopher Tortoise Conservation Permit to avoid adverse effects to this species.

4.4 CLIMATE**Significance Thresholds**

The FAA has not established a significance threshold or factors to consider for climate.

Environmental Consequences

Previous GHG emissions analyses of potential RLV operations were used to support the analysis in this EA. GHG emissions analysis presented in the Midland International Air and Space Port Final EA (2014), is used to quantify GHG emissions of the Concept Y RLV for this EA.

Although there are no federal standards for aviation-related GHG emissions, it is well established that GHG emissions can affect climate. As of 2016, the United States annually emits 5.3 trillion

metric tons of CO₂, of which approximately 34% are from transportation.³ Aircraft have been calculated to contribute approximately nine percent of U.S. CO₂ emissions.⁴

No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to TCAA for the operation of a launch site at TIX. No physical development requiring environmental review approvals under NEPA related to the use of RLVs would be undertaken. The No Action Alternative would not introduce RLV operations at TIX and would not result in changes to the natural, physical, or social environment. Ongoing aviation growth at TIX would continue and future operational conditions could differ from existing conditions. Maintenance activities (e.g., mowing, hay production) would also continue at TIX. There would be no impacts to climate.

Proposed Action

The Midland 2014 Final EA considered a total of 520 annual launches of the Concept Y RLV. However, for this EA, a total of 50 launches of the Concept Y RLV are considered for the GHG analysis. Since this is significantly less than the 520 launches considered in the Midland 2014 Final EA, the annual operation GHG emission estimates are divided by 520 in order to determine the approximate GHG emissions per launch. The GHG emissions per launch are then multiplied by 50 to estimate the Concept Y RLV annual GHG emissions per year. Data from the Houston Spaceport Final EA (2015) was used to estimate Concept X and Z RLV GHG emissions. This analysis considers 50 launches of each RLV when calculating potential emissions. This method provides a conservative analysis of GHG emissions, as 50 total RLV launches per year are assumed under the Proposed Action.

Annual CO₂ emissions of the combined Concept X, Y, and Z RLV operations would be conservatively about 3,000 metric tons^{5,6}. The annual CO₂ emissions associated with launches of an RLV would be insignificant compared to the total CO₂ emissions from the U.S. GHG emissions from propellant and oxidizer combustion during take-off, rocket ignition, and landing occur up to the stratospheric level. O₃ depleting substance emissions from the takeoff of Concept RLVs to the stratosphere are not of concern because the operation of the proposed concept RLVs are not

³ USEPA, *Fast Facts*, https://www.epa.gov/sites/production/files/2018-04/documents/9509_fastfacts_20180410v2_508.pdf, April 2018 (March 7, 2019).

⁴ USEPA, *Green Vehicle Guide*, <https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions>, August 27, 2018 (March 7, 2019).

⁵ FAA, Final EA and FONSI for the Midland International Air and Space Port, https://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/nepa_docs/review/operator/, September 2014 (March 7, 2019).

⁶ FAA, Final EA and FONSI/ROD for the Houston Spaceport, https://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/nepa_docs/review/operator/, June 2015 (March 7, 2019).

anticipated to emit hydrogen chloride or chlorine ions that would lead to significant impacts related to O₃ depletion.

Implementation of the Proposed Action may have indirect climate impact. An RLV operator based at the Airport could have a direct employment of approximately 20 to 40 people. This would lead to an increase in vehicle miles traveled to and from the Airport. Assuming an RLV operator could have direct employment of 20 to 40 full time employees, there could be an increase of approximately 20 to 40 round trips per day to and from the Airport. The estimated number of employees is subject to change based on the number and type of operations. In addition, delivery trucks have the potential to store a greater amount of propellant than what may be needed per launch, the maximum possible number of propellant deliveries would occur if on-site storage tanks were not used and separate truck trips for fuel and for oxidizer were used to supply each of the 50 launches, for a conservative total of 100 truck round trips per year. The actual number of truck trips expected to support the Proposed Action at TIX would be lower. The increase in vehicle miles travelled by employees and the delivery of propellant would not significantly the global climate.

Estimated annual GHG emissions associated with the Proposed Action for each year of the proposed launch site operator license (2020 to 2025) are compared to total U.S GHG emissions estimated for year 2016 in **Table 4.2**. The estimated emissions from the Proposed Action represent only a tiny fraction of total GHG emissions generated in the U.S.

Table 4.2 Greenhouse Gases: Comparison of Proposed Action Emissions to Total U.S. Emissions		
Proposed Action Emissions (any year of license)	United States Emissions (2016)	Fraction of U.S. Emissions from Proposed Action
3,000 metric tons	6,411,300,000 metric tons	0.00000047
Source: USEPA, "Greenhouse Gas Inventory Data Explorer," https://www3.epa.gov/climatechange/ghgemissions/inventoryexplorer/#allsectors/allgas/gas/current , 2016 (March 6, 2019)		

4.5 COASTAL RESOURCES

Significance Threshold

The FAA has not established a significance threshold for coastal resources. Factors to consider when evaluating whether impacts would be significant include whether the action would have the potential to:

- Be inconsistent with the relevant state coastal zone management plan(s);
- Impact a coastal barrier resources system unit (and the degree to which the resource would be impacted);
- Pose an impact to coral reef ecosystems (and the degree to which the ecosystem would be affected);
- Cause an unacceptable risk to human safety or property; or
- Cause adverse impacts to the coastal environment that cannot be satisfactorily mitigated.

Environmental Consequences

No Action Alternative

Under the No Action Alternative, no new spaceport infrastructure would be constructed at TIX and no RLV operations would occur from TIX. Existing TIX operations would continue. This alternative would not affect coastal resources.

Proposed Action

The Proposed Action is located within Florida's coastal zone and involves a request to the FAA for a license to operate a commercial spaceport at TIX and potentially a request for FAA funding; therefore, the Proposed Action is subject to FCMP federal consistency review. The consistency review will be initiated with the distribution of the Draft EA to the State Clearinghouse at the Office of Intergovernmental Programs and subsequent review by interested state and local agencies. The final review of the Proposed Action's consistency with respect to the FCMP will be conducted after completion of the EA during the Environmental Resource Permitting (ERP) phase of the project. In response to the Project Notification and Request Letter during project scoping, the FDEP provided a preliminary determination that the Proposed Action would be consistent with the FCMP (refer to **Appendix B**).

Because construction would be restricted to inland areas, and runoff from the project areas drains inland toward the St. Johns River basin instead of toward the Banana River Lagoon, coastal barriers, coral reefs, and coastal environments would not be affected. Based on the FDEP's

preliminary determination that the Proposed Action would be consistent with the FCMP, no significant impacts to coastal resources are anticipated.

4.6 DEPARTMENT OF TRANSPORTATION ACT: SECTION 4(F)

Significance Threshold

Impacts would be significant if the action involves more than a minimal physical use of a Section 4(f) property or constitutes a constructive use based on an FAA determination that the aviation project would substantially impair the Section 4(f) resource.

Environmental Consequences

No Action Alternative

Under the No Action Alternative, there would be no spaceport related construction, no RLV launches from TIX, and no RLV-related noise impact originating from TIX. Because there would be no construction, there would be no physical use of a Section 4(f) resource. Aircraft noise would be audible within the sanctuary; however, Airport noise has been a constant within the sanctuary since its establishment in 1991 because the Airport predates the sanctuary.

As described in **Section 3.12**, the procedures and standards for analyzing noise exposure compatibility are set forth in 14 CFR Part 150. Per these regulations, all uses are compatible with noise exposure levels less than DNL 65 dBA. The “nature exhibits and zoos” land use type is compatible with noise levels less than DNL 70 dB (**Table 3-10**). Of the land use types listed in **Table 3-10**, this is the land use category that is most similar to the land use at the Enchanted Forest Sanctuary. The DNL 70 dB and the DNL 65 dB contours for the No Action Alternative for years 2018 and 2023 do not extend off of Airport property (**Figures 4-3 and 4-4**). Therefore, the land use in the sanctuary would be considered compatible with the No Action Alternative noise exposure levels modeled for 2018 and 2023 according to 14 CFR Part 150 standards.

Under the No Action Alternative, noise would not be so severe in any of the Section 4(f) properties that their activities, features or attributes that qualify them for protection under Section 4(f) would be substantially impaired.⁷ Therefore, no constructive use of 4(f) resources would occur. Accordingly, the No Action Alternative would not result in significant impacts to Section 4(f) resources.

⁷ FAA, Order 1050.1F, “Environmental Impacts, Policies and Procedures,” Appendix B, 2.2.2, December 15, 2016.

Figure 4-3 2018 Noise Contours Relative to 4(f) Properties

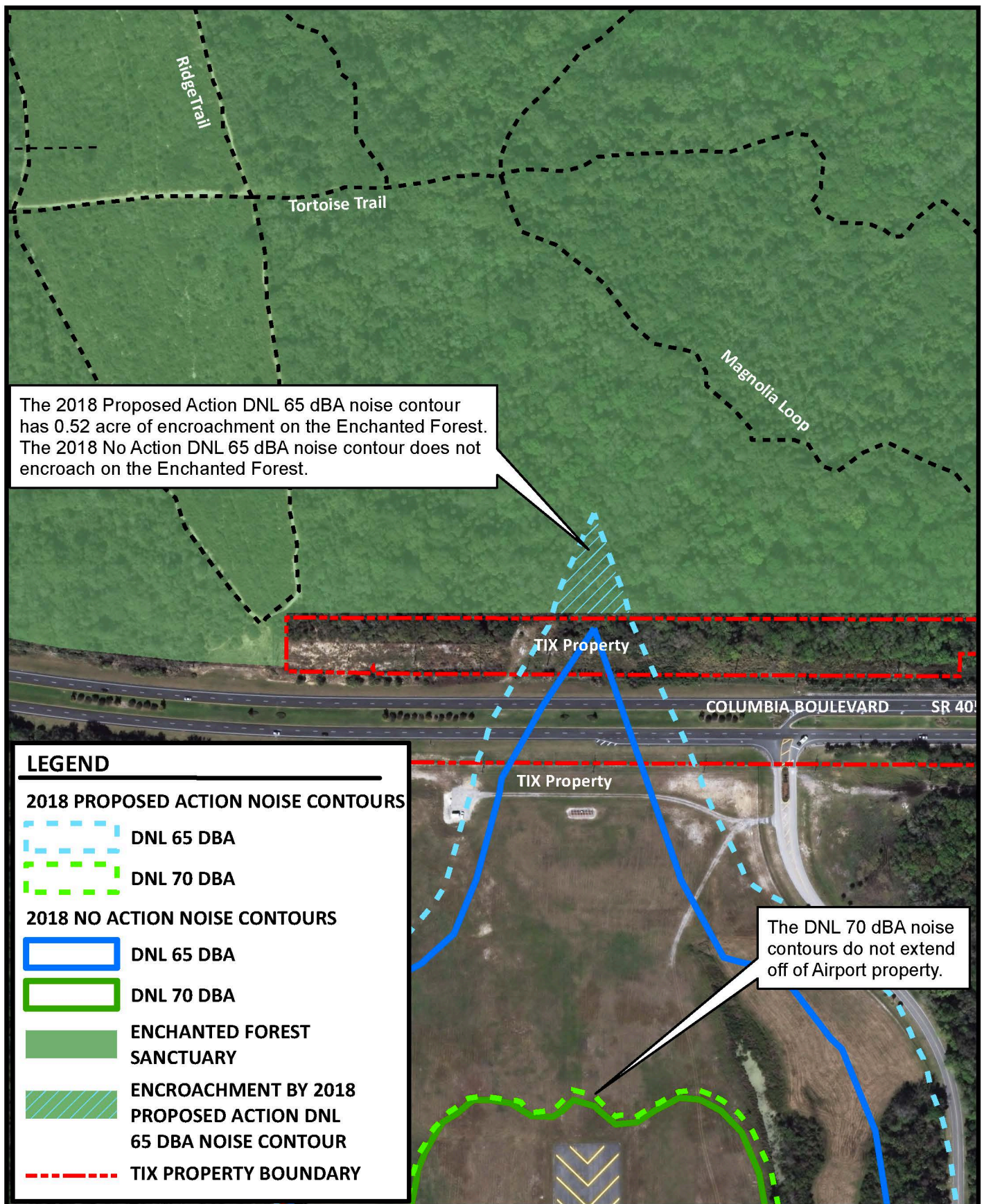
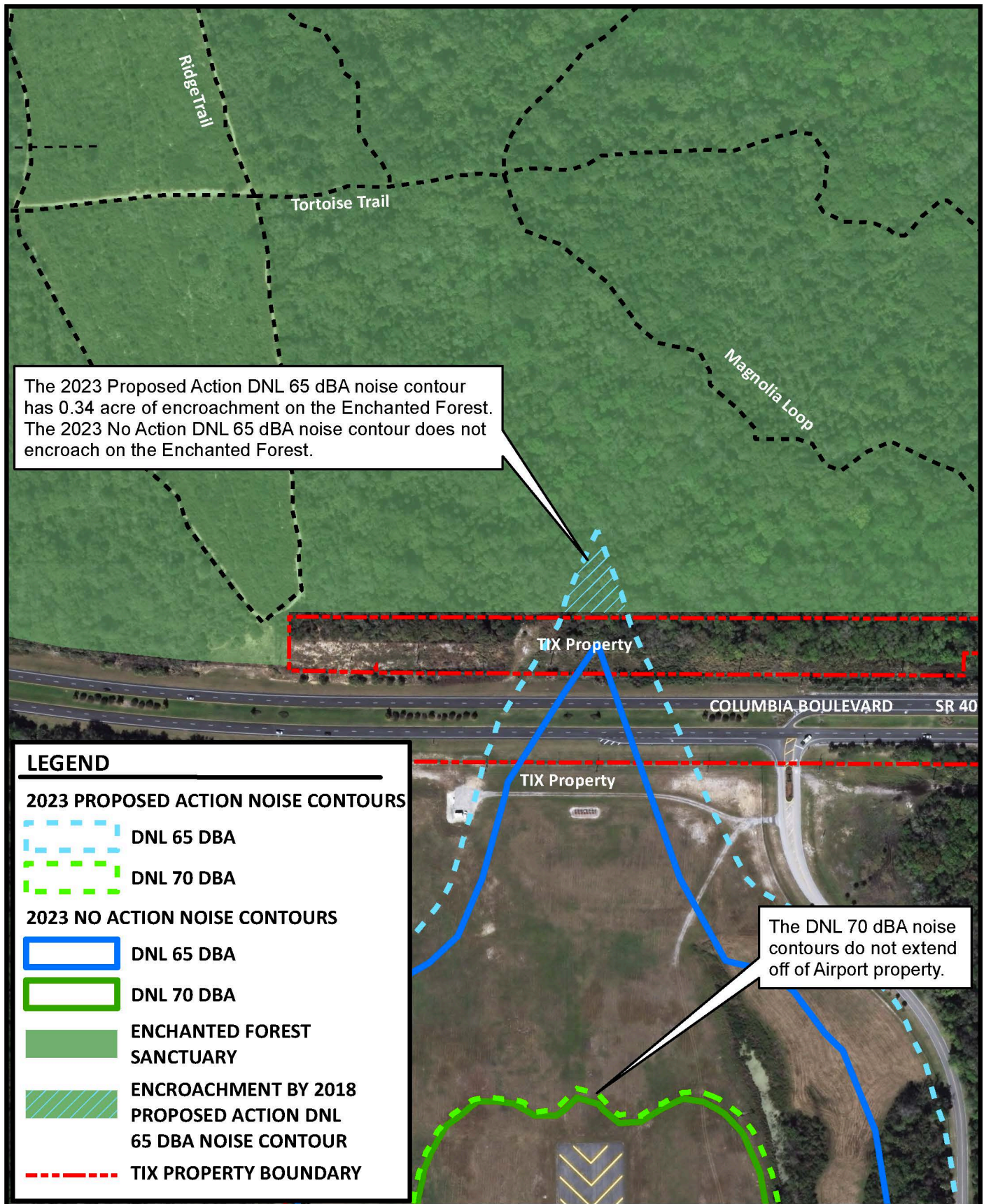


Figure 4-4 2023 Noise Contours Relative to 4(f) Properties



Proposed Action

Construction of the improvements associated with the Proposed Action would occur on TIX property and would not directly impact any Section 4(f) properties. Therefore, the Proposed Action would not result in a physical use of Section 4(f) properties.

The 2018 and 2023 Proposed Action DNL 65 dB noise contours overlap property within one Section 4(f) resource, the Enchanted Forest Sanctuary. Based on the results of the noise analysis, the 2018 Proposed Action DNL 65 dB noise contour would overlap 0.52 acre of the sanctuary (**Figure 4-3**), and the 2023 Proposed Action DNL 65 dB noise contour would overlap 0.34 acre of the sanctuary (**Figure 4-4**).

This increase in the 65 dB noise contours relative to the No Action Alternative would be due to additional noise resulting from a maximum of 50 RLV launches per year from TIX over the five-year term of the launch site operator license under the Proposed Action. However, as shown in **Figures 4-3** and **4-4**, the Proposed Action DNL 70 dB noise contours for 2018 and 2023 do not encroach on the Enchanted Forest Sanctuary. Therefore, using the guidance in 14 CFR Part 150, the land use within the sanctuary remains compatible with the modeled noise exposure levels that would be present in 2018 and 2023, because this land use type is considered compatible with noise exposure levels less than DNL 70 dB.

Brevard County's Environmentally Endangered Lands Program was started in 1990, and the Enchanted Forest Sanctuary was established soon afterward, in 1991. Although the Enchanted Forest Sanctuary Management Plan does not include discussion on the adjacent airport operations and its noise effects on current use of the resource, the Airport had been operating for many years prior to the establishment of the sanctuary. The portion of the sanctuary that is overlapped by the 2018 and 2023 Proposed Action DNL 65 dB noise contours is also just north of State Route 405 (Columbia Boulevard), which is a major 4-lane divided highway that was constructed many years prior to the establishment of the sanctuary (based on review of 1969 aerial photography), so noise from the Airport and the highway have always been present in this portion of the sanctuary.

As shown in **Figures 4-3** and **4-4**, the portion of the sanctuary that is overlapped by the 2018 and 2023 Proposed Action DNL 65 dB noise contours contains an area of wetland habitat. The nearest trails to the 2018 Proposed Action DNL 65 dB contour boundary are located outside of the contour, over 575 feet to the west (596 feet in 2023) and over 380 feet to the northeast (400 feet in 2023) of the contour, respectively. Per the guidelines of the sanctuary, users of the sanctuary are requested to "stay on the trail for personal safety and protection of the natural

environment.”⁸ Therefore, users of the sanctuary should always be in areas well outside the limits of the 2018 and 2023 Proposed Action DNL 65 dB contour.

Coordination with the Brevard County Environmentally Endangered Lands Program was initiated to seek their comments regarding the potential for constructive use impacts to the Enchanted Forest Sanctuary. The Environmentally Endangered Lands Program Manager reviewed correspondence describing the Section 4(f) impact analysis conducted for this EA. Although the Program Manager did not dispute the conclusions of the analysis (that found no constructive use impact to the Enchanted Forest Sanctuary) and did not state an objection to the Proposed Action, he elected not to take a position on the potential for Section 4(f) constructive use impact. A copy of this correspondence is provided in **Appendix B**.

In summary, based on the results of the noise analysis (**Section 4.12**), noise exposure levels would remain below DNL 70 dB throughout the Enchanted Forest Sanctuary under the Proposed Action. Therefore, under 14 CFR Part 150 noise compatibility standards, the noise levels would not be significant.⁹ As such, the noise impacts to the Enchanted Forest Sanctuary would be minimal and would not be considered a constructive use of this resource. The other Section 4(f) resources within the vicinity of TIX, Tom Statham Park and Manatee Hammock Campground, would not be directly affected by construction and they are not located within the area overlapped by the 2018 and 2023 Proposed Action DNL 65 dB noise contours.

Accordingly, the FAA has determined the Proposed Action would not substantially diminish the protected activities, features, or attributes of any of the Section 4(f) properties identified, and thus would not result in substantial impairment of the properties. Therefore, the Proposed Action would not be considered a constructive use of these Section 4(f) properties and would not result in significant impacts.

4.7 FARMLANDS

Significance Threshold

Impacts would be significant if a total combined score on Form AD-1006 is between 200 and 260 points.

⁸ Brevard County. *The Enchanted Forest Sanctuary*, <http://www.brevardcounty.us/EELProgram/Areas/EnchantedForestSanctuary/Home>, 2017 (March 7, 2019).

⁹Code of Federal Regulations, Title 14 § 150, Appendix A.

Environmental Consequences

No Action Alternative

The No Action Alternative would not include new construction for spaceport-related development and would not result in the conversion of farmland. Existing Airport operations do not affect farmland. Therefore, the No Action Alternative would not affect farmlands.

Proposed Action

Construction of spaceport infrastructure would occur on soils designated by the NRCS as farmland soils of unique importance (see **Figure 3-7**). Based on the results from the completion of Form AD-1006, the total combined score for the area that would be converted or directly impacted by the Proposed Action was 60 points, which is far below the significance threshold of 200 and 260 points. Therefore, the Proposed Action would not result in significant farmland impacts.

4.8 HAZARDOUS MATERIALS, SOLID WASTE, AND POLLUTION PREVENTION

Significance Threshold

The FAA has not established a significance threshold for hazardous materials, solid waste, and pollution prevention. Factors to consider when evaluating whether impacts would be significant include whether the action would have the potential to:

- Violate applicable Federal, state, tribal, or local laws or regulations regarding hazardous materials and/or solid waste management;
- Involve a contaminated site (including but not limited to a site listed on the National Priorities List). Contaminated sites may encompass relatively large areas. However, not all of the grounds within the boundaries of a contaminated site are contaminated, which leaves space for siting a facility on non-contaminated land within the boundaries of a contaminated site. An Environmental Impact Statement is not necessarily required. Paragraph 6-2.3.a of FAA Order 1050.1F allows for mitigating impacts below significant levels (e.g., modifying an action to site it on non-contaminated grounds within a contaminated site). Therefore, if appropriately mitigated, actions within the boundaries of a contaminated site would not have significant impacts;
- Produce an appreciably different quantity or type of hazardous waste;
- Generate an appreciably different quantity or type of solid waste or use a different method of collection or disposal and/or would exceed local capacity; or
- Adversely affect human health and the environment.

Environmental Consequences

No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to TCAA for the operation of a commercial space launch site at TIX. The No Action Alternative would not introduce RLV operations at TIX; therefore, this alternative would not affect existing conditions related to hazardous materials, solid waste or pollution prevention. Additionally, the No Action Alternative would not directly or indirectly affect any of the RCRA sites on TIX property. It should be noted that ongoing aviation growth at TIX would continue and that future operational conditions could increase over existing conditions. However, these changes would not result in the generation of an appreciably different quantity or type of hazardous or solid waste. Airport operations would maintain compliance with existing Federal, state, and local requirements regarding hazardous materials, solid waste, and pollution prevention.

Proposed Action

Similar to the No Action Alternative, the Proposed Action would not directly or indirectly affect any of the RCRA sites on TIX property. Implementation of the Proposed Action is not likely to change TCAA's status as a conditionally exempt small quantity generator of hazardous waste.¹⁰ The primary reason for this is that the RLV operator would be the entity that would own the materials used in the RLV, not TIX.

Construction activities would not significantly increase the quantities of hazardous materials at TIX. Construction activities would cause a temporary increase in municipal solid waste from the removal and disposal of inorganic materials and vegetation during clearing and grubbing activities. Construction wastes would be managed in accordance with existing regulations at the Airport for solid and hazardous waste management. The closest landfill to the Airport is the Brevard County Landfill, approximately 10 miles southwest of the project study area. The landfill is expected to have sufficient capacity to handle the disposal needs of the County as described in **Section 3.8.2**. It is also possible that some hazardous waste could be generated during the construction phase. Hazardous waste is typically removed by a licensed hazardous waste removal vendor. Such companies containerize and temporarily store accumulated hazardous waste and then ship accumulated materials out of state to a hazardous waste receiving facility. There are no receiving facilities in Florida for permanent storage and disposal,¹¹ although there are centers for recycling some hazardous materials such as batteries and electronics.

¹⁰ FDEP, Hazardous Waste Facilities Search Results, http://appprod.dep.state.fl.us/www_rcra/reports/handler_results.asp?epaid=FLR000102673, (March 6, 2019).

¹¹ Personal communication, Lu Burson, Florida Department of Environmental Protection, March 6, 2019.

Operational activities associated with the Proposed Action would result in an increase in quantities and types of hazardous materials used at TIX. This increase would be primarily due to the use of propellants and oxidizers related to RLV operations. Fuels include RP-1, kerosene blend or Jet-A fuel, HTPB, polyamide plastic (nylon), and ABS plastic. Oxidizers include LOX, N₂O, and hydrogen peroxide (H₂O₂). While the liquid fuels are considered hazardous materials, unused product is not considered hazardous waste because it is recyclable.

No new fuel farms and/or onsite storage tanks would be required under the Proposed Action. Liquid fuels (RP-1, kerosene blend) and oxidizers used to support RLV operations would be delivered using tanker trucks from an offsite storage location and would not be stored onsite except during loading and unloading activities. The propellants are similar in composition and management requirements to Jet-A fuel currently used at the Airport. Jet-A fuel would continue to be supplied according to existing standard operating procedures at the Airport, and the quantity required under the Proposed Action is within the existing storage and management capacities. Delivery trucks have the potential to store a greater amount of propellant than what may be needed per launch. Separate truck trips for fuel and for oxidizer would be used to supply each of the 50 launches. Fuels and oxidizers would be stored and used in compliance with Title 14 CFR §420.65-70 for solid and liquid propellants. Unused liquid fuels or oxidizers in the tanker trucks would be returned to the distributor.

As many as ten hybrid rocket motor casings containing solid fuels (ABS, polyamide plastic, and HTPB), weighing up to 3,000 lbs. each, could be stored in an operational hangar. These materials are considered inert and are unlikely to be released to the environment. In addition to the fuels and oxidizers, small quantities of other hazardous materials (e.g., various composites, synthetics, and metals) may be used for RLV operations, including solvents, oils, and paints. Since these materials and the waste generated from their use would be the responsibility of the operator, it is likely that the operator would be classified as a small quantity generator, similar to many fixed base operators.

Table 4.3 shows the maximum quantities of oxidizers and propellants that could be onsite at any given time under the Proposed Action.

Under the Proposed Action, the Airport would implement measures to ensure hazardous materials and wastes are handled, stored, and used in compliance with Federal, state, and local regulations. Such measures could include:

- Updating the Spill Prevention, Control, and Countermeasure (SPCC) plan measures associated with transporting equipment and materials;

Table 4.3 Oxidizer and Propellant Quantities and Storage		
Oxidizers/Fuels	Maximum Quantity (1000's of lbs.)	Storage
LOX	47.5	Offsite, delivered by tanker truck
N ₂ O	54	Offsite, delivered by tanker truck
H ₂ O ₂	1.2	Offsite, delivered by tanker truck
RP-1	25	Offsite, delivered by tanker truck
Kerosene Blend	42	Offsite, delivered by tanker truck
Jet-A	239	Onsite, existing infrastructure
HTPB (solid, inert)	30	Onsite, in hangar
Nylon/ABS (solid, inert)	30	Onsite, in hangar
Source: RS&H, 2013		

- Storing bulk hazardous material in approved containers meeting National Fire Protection Association industrial fire protection code and required contaminant systems; and
- Storing hazardous materials in protected and controlled areas designed to comply with site-specific SPCC plans.

RLV operators would be required to implement an SPCC plan. The SPCC would contain detailed information concerning the storage and handling of rocket fuels, propellants, and oxidizers, and should reflect a knowledge of the characteristic properties of each such as those on the Material Safety Data Sheet, the potential for interactions among the various substances, as well as distances required for maintaining public safety. The SPCC would also specify procedures for cleanup in the event of a spill.

In the unlikely event of a launch failure, the debris impacts would be expected to be contained within the FAA approved hazard area defined for that RLV. For each mission, TCAA would work with the launch operator and the FAA to establish hazard areas to ensure public safety according to regulations in 14 CFR Part 431 or 437. Appropriate emergency response materials, equipment, training, and procedures will be in place prior to launch. Any potential impacts would be minimized by emergency response procedures as outlined in the Airport Certification Manual for TIX.

Storage tanks and fueling activities would be managed in accordance with Federal, state, and local regulations. Uncontrolled releases would be reported to the appropriate Federal, state, and local authorities and would be cleaned accordingly. Proper handling practices for propellants and other hazardous materials would maintain the safety of Airport operations and the travelling public, and limit the potential for releases of hazardous materials into the local environment. The Proposed Action would comply with all existing hazardous materials handling and transportation requirements within the ROI. By following regulations for hazardous materials, the transportation, storage, and use of hazardous materials associated with the Proposed Action would not pose a substantial hazard to the public or environment, and impacts would be less than significant.

4.9 HISTORICAL, ARCHITECTURAL, ARCHEOLOGICAL, AND CULTURAL RESOURCES

Significance Threshold

The FAA has not established a significance threshold for historical, architectural, archeological and cultural resources. Factors to consider in evaluating whether impacts would be significant include whether the action would result in a finding of Adverse Effect through the Section 106 process. However, an adverse effect finding does not automatically trigger preparation of an Environmental Impact Statement (i.e., a significant impact).

Environmental Consequences

As previously described in **Section 3.9**, no historic structures, including properties currently listed on or determined eligible for listing in the National Register for Historical Places, were previously recorded within the APE. Based on the *Phase I Cultural Resource Assessment Survey of the Space Coast Regional Airport* (see **Appendix F**), six resources were newly identified and recorded within the APE. However, as described in **Section 3.9**, these surveyed structures of the Airport are typical examples of their type without any design features, or historical associations that would make them significant or eligible for listing in the National Register. They do not meet the criteria for listing in the National Register of Historic Places and are not historic properties for the purposes of Section 106. As a result, there are no historic structures in the APE.

Based on the *Phase I Cultural Resource Assessment Survey of the Space Coast Regional Airport* (see **Appendix F**) and SHPO's review of the project (see **Appendix B2** for correspondence letter) there are no known archaeological sites within the APE where ground disturbing activities would occur.

No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to TCAA for the operation of a launch site at TIX. No physical spaceport- related development requiring environmental review under NEPA would be undertaken. The No Action Alternative would not introduce RLV operations at TIX, therefore, this alternative would not affect historic, architectural, archaeological or cultural resources. It should be noted that ongoing aviation growth at TIX would continue and that future operational conditions could differ from existing conditions.

Proposed Action

There are no significant historical or archaeological resources in the APE. Therefore, the Proposed Action would not impact any known Historic Properties.

As requested by SHPO in the scoping letter dated August 21, 2013 (**Appendix B3-48**), if prehistoric or historic artifacts associated with Native American cultures, or early colonial or American settlement are encountered within the area of construction associated with the Proposed Action, all ground-disturbing activities within 25 feet of the discovered resource would stop immediately. The contractor would immediately contact TCAA, the Florida SHPO, the Tribal Historic Preservation Officer, FAA, and other proper authorities in accordance with Section 872.05, *Florida Statutes*. TCAA would ensure a qualified archaeologist is called as soon as possible to assess the situation. Consultation with the Florida SHPO would be conducted to determine NRHP eligibility of the resource and, if a Historic Property exists, seek recommendations for the treatment of the discovery.

4.10 LAND USE**Significance Threshold**

The FAA has not established a significance threshold or factors to consider for land use impacts. The determination that significant impacts exist in the land use impact category is normally dependent on the significance of other impacts.

Environmental Consequences*No Action Alternative*

Under the No Action Alternative, there would be no spaceport-related construction and no RLV launches from TIX. No changes in current land uses related to spaceport operation or development would occur as a result of the No Action Alternative. Development as a result of

normal airport growth related to conventional aircraft operations would be expected, but such growth and development would be likely occur on property owned by TIX that is already zoned for Public Use that is compatible with airport development. Therefore, the No Action Alternative would be compatible with existing land use, and no significant impacts would occur.

Proposed Action

Construction activities associated with the Proposed Action would occur primarily on land zoned for Public Use (58.6 acres), with the remaining area (1.6 acres) being on land zoned industrial (or heavy industrial). which, is considered compatible with airport development but may require approval as conditional use by the City Council.¹² The Proposed Action would not result in any disruptions to surrounding communities and would be consistent with the current land uses at and in the vicinity of TIX. While Airport operations would increase over existing conditions, the Proposed Action would not result in a change in the existing land use at and in the vicinity of TIX. Therefore, there would be no significant land use impacts.

4.11 NATURAL RESOURCES AND ENERGY SUPPLY

Significance Threshold

The FAA has not established a significance threshold for natural resources and energy supply. Factors to consider in evaluating whether impacts would be significant include whether the action would have the potential to cause demand to exceed available or future supplies of these resources.

Environmental Consequences

No Action Alternative

Under the No Action Alternative, TCAA would not obtain a launch site operator license. The Airport would continue to operate to meet its current and forecasted aviation demand; however, no new spaceport-related facilities would be constructed under the No Action Alternative and no RLV launches would occur. Therefore, there would be no additional impacts to local supplies of energy and no natural resources would be used or expended due to construction of spaceport facilities under the No Action Alternative. Natural resource and energy use associated with the No Action Alternative may gradually increase due to normal forecast growth in operations at the Airport. The No Action Alternative would not result in significant impacts to natural resources and energy supply.

¹² City of Titusville, *Code of Ordinances*, Sec. 28-53 and 28-54, <http://library.municode.com/index.aspx?clientId=12259> January 29, 2019 (March 6, 2019).

Proposed Action

The materials used to construct facilities associated with the Proposed Action would largely consist of concrete for the hangar foundation, apron, fuel and oxidizer storage areas (tanker truck parking areas), and oxidizer loading area; asphalt for the realigned portion of Perimeter Road, the new taxiway, the proposed access roads and parking areas; and a pre-engineered steel building system for the hangar/RLV manufacturing facility as described in **Section 3.11**. These are materials that are readily available in large quantities that would be obtained from off-site locations.

The Proposed Action would also involve installation of additional lighting for the RLV development and production hangar, taxiway, apron, and parking areas. Energy demands resulting from the additional electrical power consumed by these facilities would be minor changes that would not have a significant effect on energy supply in the region.

A gradual increase in annual aircraft operations is projected with activity anticipated to increase less than 4 percent from 2015 to 2023, growing from 108,872 operations in 2015 to 113,012 operations in 2023.¹³ This anticipated increase in operations is due to normal growth and not attributed to the Proposed Action; therefore, no significant increase in energy demand at TIX would be expected to result from implementation of the Proposed Action.

Some water would be used for construction processes for the spaceport related facilities, and once an RLV operator is using the facility there would be some water use by the employees and customers of the RLV operator. The City of Titusville's sanitary sewer utility services would also treat wastewater from the RLV operator's facility, but this additional utility demand would be a minor change that would not significantly affect water supply or treatment capacity. According to the City of Titusville's 2018 Evaluation and Appraisal Report, the City's Water Resources Department has indicated that there is both adequate water and sewer capacity to handle anticipated growth into the future.¹⁴

A temporary increase of fossil fuel consumption would be anticipated during construction, but this would be temporary and minor in nature, and would not measurably affect availability of fuel on a local or regional scale. The Proposed Action would result in a maximum of 50 RLV operations per year during the term of the launch site operator license from 2020 to 2025. This number of operations at TIX would not create an excessive demand for liquid fuels (Jet A or RP-

¹³ Michael Baker International, 2015.

¹⁴ City of Titusville Planning Department, 2018 Evaluation and Appraisal Report, <https://www.titusville.com/SIB/files/Evaluation%20and%20Appraisal%20Review.pdf>, May 2018 (March 7, 2019).

1). In summary, the Proposed Action would not result in significant impacts on natural resources and energy supply.

4.12 NOISE AND NOISE COMPATIBLE LAND USE

Significance Threshold

Impacts would be significant if the action would increase noise by DNL 1.5 dB or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dB noise exposure level, or that will be exposed at or above the DNL 65 dB level due to a DNL 1.5 dB or greater increase, when compared to the no action alternative for the same timeframe. For example, an increase from DNL 65.5 dB to 67 dB is considered a significant impact, as is an increase from DNL 63.5 dB to 65 dB. Special consideration needs to be given to the evaluation of the significance of noise impacts on noise sensitive areas within Section 4(f) properties (including, but not limited to, noise sensitive areas within national parks; national wildlife and waterfowl refuges; and historic sites, including traditional cultural properties) where the land use compatibility guidelines in 14 CFR part 150 are not relevant to the value, significance, and enjoyment of the area in question. For example, the DNL 65 dB threshold does not adequately address the impacts of noise on visitors to areas within a national park or national wildlife and waterfowl refuge where other noise is very low and a quiet setting is a generally recognized purpose and attribute.

Environmental Consequences

As per FAA Order 1050.1F, Appendix B-1.2, Federal Aviation Administration Approved Models for Detailed Noise Analysis, the FAA implemented a non-standard noise methodology to predict noise levels of RLV launches. On September 22, 2014, the FAA Office of Environment and Energy determined that this non-standard methodology was appropriate for use in this EA and provided its approval of the noise methodology, as required by FAA Order 1050.1F (Appendix G).

A-weighted DNL is a cumulative noise metric that includes noise from all flight operations (i.e., TIX aviation operations and TIX Concept X, Y, and Z RLV operations) over a 24-hour annual average day. The No Action Alternative noise levels generated from aviation operations were modeled using the Integrated Noise Model (INM, Version 7.0d). The baseline year used for the noise analysis was 2015. INM was used because this EA and the noise analysis were begun prior to FAA's adoption of Aviation Environment Design Tool as the preferred noise model. The Proposed Action noise levels generated from aviation and concept RLV operations were modeled using a combination of output from INM and the Launch Vehicle Acoustic Simulation Model (RUMBLE). INM was used to predict the noise levels generated by aviation operations and the Concept X and Z RLV operations. RUMBLE was used to calculate the noise levels generated by the

Concept Y RLV. The noise levels modeled by INM were combined with the Concept Y RLV noise levels modeled by RUMBLE, resulting in the DNL noise contours of the Proposed Action (aviation and Concept X, Y, and Z RLVs operations). The community noise exposure of the Proposed Action on a DNL basis in 2018 and 2023 was then compared to the No Action Alternative in 2018 and 2023, respectively, to determine if a significant noise impact would occur as a result of the Proposed Action.

A sonic boom is the sound associated with the shock waves created by the RLV traveling through the air faster than the speed of sound. The duration of a sonic boom is less than a second, and the intensity is generally greatest directly under the flight path and weakens as distance from the flight track increases. The sonic boom resulting from the supersonic portion of the departure would not reach the ground due to the steep ascending flight path angle, as the boom propagates along an angle that would not intercept the ground. To quantify the potential impact of sonic boom generation related to RLV operations, the analysis uses PCBoom4, a single-event prediction model. PCBoom4 is used by the Air Force Center for Engineering and Environment and is widely accepted to determine the specific pattern and amplitude of a sonic boom footprint.

The following subsections compare the potential noise effects of the Proposed Action in 2018 and 2023 to the No Action Alternative in 2018 and 2023, respectively.

No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to TCAA for the operation of a launch site at TIX. No spaceport-related physical development requiring environmental review approvals under NEPA would be undertaken, therefore no spaceport-related construction noise impacts would occur in association with the No Action Alternative. The No Action Alternative would not introduce RLV operations at TIX, therefore, this alternative would not affect noise or non-compatible land uses. It should be noted that ongoing aviation operations at TIX would continue and that future operational conditions could differ from existing conditions.

Noise exposure contours resulting from aircraft operations at TIX in 2018 and 2023 are depicted as DNL 65, 70, and 75 dBA contours in **Figures 4-5 and 4-6**, respectively. As with the 2015 Existing Condition DNL 65 dBA noise contour depicted in **Figure 3-10**, the No Action Alternative DNL 65 dBA contours for 2018 and 2023 only extend off of Airport property to the east of the approach end of Runway 27 over an area of industrial land use that is compatible with the Airport noise environment.

Figure 4-5 2018 Noise Contours

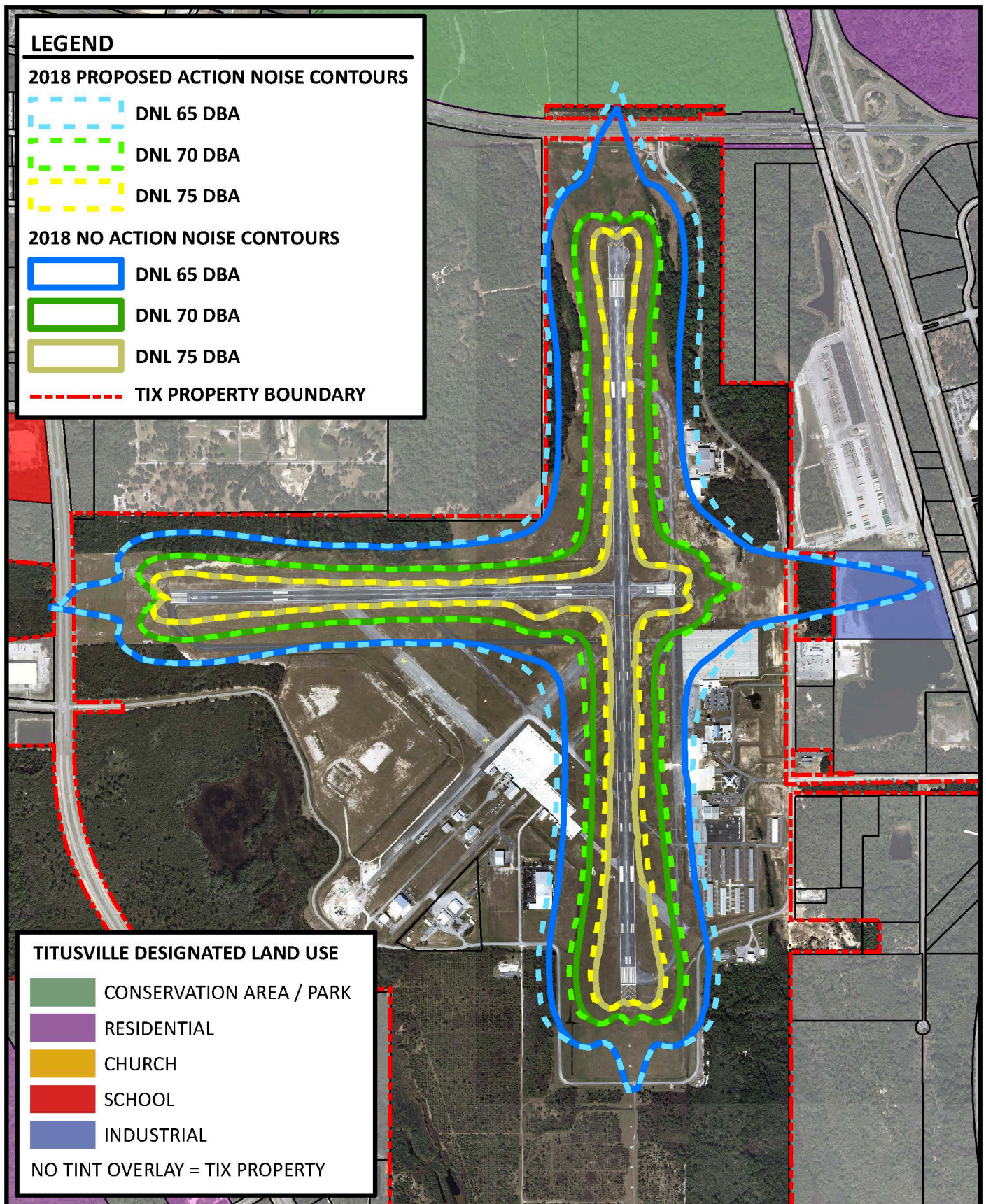
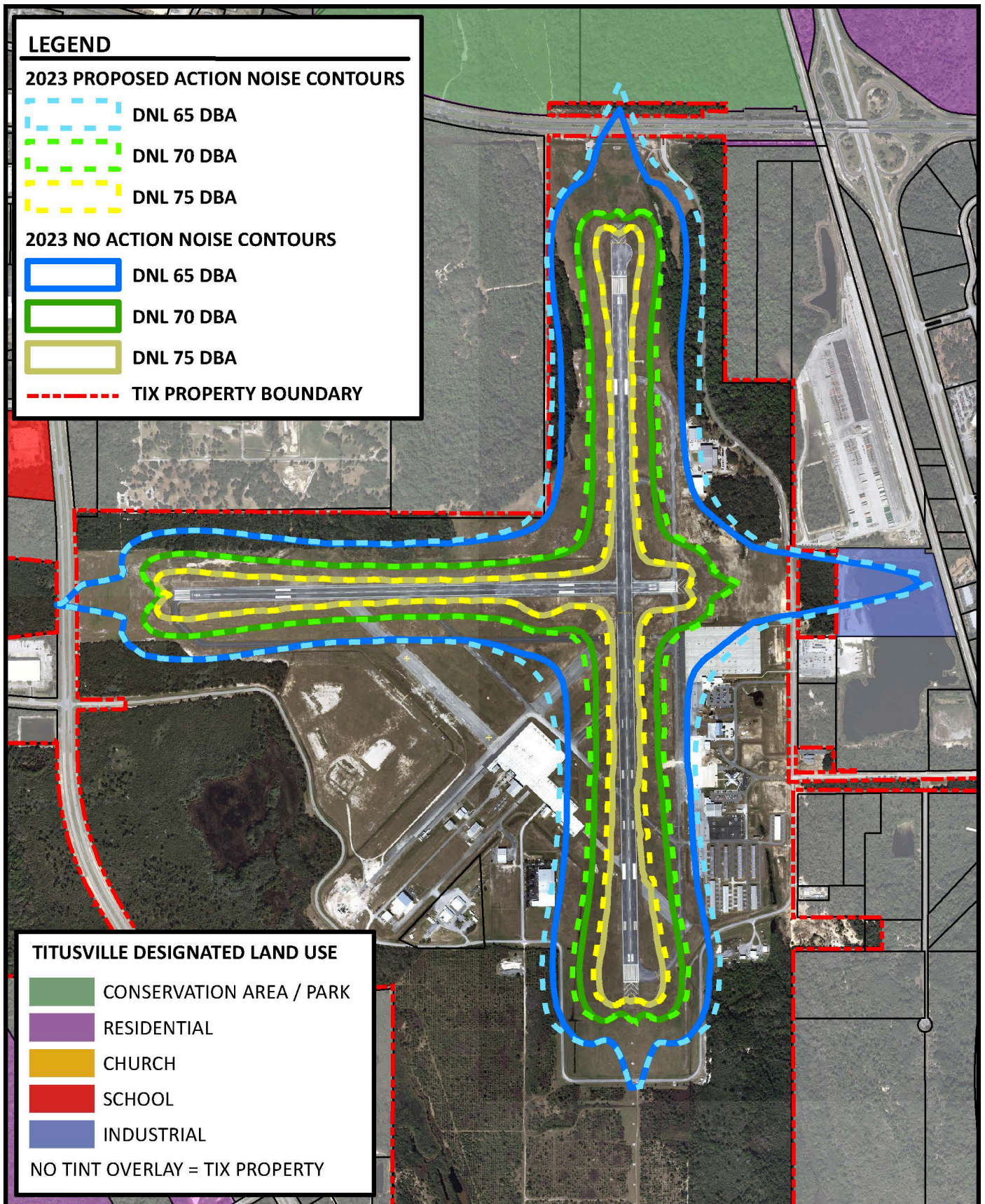


Figure 4-6 2023 Noise Contours



Proposed Action

The noise analysis of the Proposed Action assessed the forecast of operations of the Concept X, Y, and Z RLVs, in addition to the 2018 and 2023 forecast of aircraft operations at TIX. RLV nighttime operations (which include a 10-dB penalty in noise modeling) were modeled at five percent of the total. The DNL noise analysis also includes static operations of a Concept Y RLV pre-flight rocket engine run-up.

DNL noise contours were prepared for 2018 and 2023, which for the model included the proposed RLV operations (50 per year) and the forecast aircraft operations. **Figure 4-5** shows the DNL comparison of the No Action Alternative and Proposed Action DNL contours (DNL 65, 70 and 75 dBA) for 2018. **Figure 4-6** shows the DNL comparison of the No Action Alternative and Proposed Action DNL contours (DNL 65, 70 and 75 dBA) for 2023. **Table 4.4** depicts the acreages of the various types of land use that are found within the DNL 65 dBA noise contours for the No Action Alternative and Proposed Action for 2018 and 2023.

The Proposed Action DNL 65 dBA contours extend off of Airport property to the north and result in minor noise impact to one area of incompatible land use, the Enchanted Forest Sanctuary, which is a conservation area that is a U.S. Department of Transportation Section 4(f) resource. As shown in **Figure 4-3**, the 2018 Proposed Action DNL 65 dBA contour contains approximately 0.52 acre of incompatible land use, north of the TIX property boundary. As shown in **Figure 4-4**, the 2023 Proposed Action DNL 65 dBA contour contains approximately 0.34 acre of the incompatible land use north of the TIX property boundary. However, based on the noise analysis, these areas would not experience an increase of more than 1.5 dB in 2018 or 2023. Therefore, the Proposed Action would not result in significant noise impacts. The remaining land use types within each of the contours include Public Use, Industrial Use, and undesignated land that is within FDOT road rights-of-way. These land use types are compatible with airport and spaceport related noise as described in **Chapter 3** of this EA.

Sonic boom analysis was completed for the supersonic re-entry of the concept RLVs. **Figure 4-7** shows the sonic boom contours modeled from the nominal flight track of the Concept X and Z RLVs and for the Concept Y RLV. The sonic boom contour for the Concept X and Z RLVs covers an area of 2,564.4 square miles over the Atlantic Ocean. At its nearest point, the Concept X and Z RLV sonic boom contour is approximately 11 miles east of the Florida shoreline.

The sonic boom contour for the Concept Y RLV covers an area of 432.7 square miles over the Atlantic Ocean. For the Concept Y RLV the nearest point of the sonic boom contour is approximately 6 miles east of the Florida shoreline.

Table 4.4 Land Use within the DNL 65 dBA Noise Contours						
Year	Alternative	Total Area (Ac)	Public Use (Ac)	Conservation Area (Ac)	Industrial (Ac)	Un-designated FDOT ROW (Ac)
2018	No Action	411.4	402.7	0	6.0	2.7
	Proposed Action	460.9	450.4	0.52	7.4	2.6
2023	No Action	406.7	398.7	0	5.5	2.5
	Proposed Action	456.2	445.2	0.34	7.0	3.7
FDOT ROW – Florida Department of Transportation Road Right of Way						

The maximum noise exposure, including a sonic boom with a maximum of 0.9 psf, is predicted to be DNL 44 dBC (C-weighted). This C-Weighted DNL translates to an equivalent DNL 52 dBA (A-weighted).¹⁵ Therefore, the noise impacts from potential sonic booms modeled DNL levels are much less than the DNL 65 dBA noise exposure criteria. **Appendix H** provides additional technical information regarding the FAA approved noise analysis methodology.

Noise impacts during construction would be those associated with an increase in ambient noise levels from construction equipment. Typical noise levels generated by different types of construction equipment are presented in **Table 4.5**.

Construction operations are typically broken down into several phases including clearing and grubbing, earthwork, erection, paving and finishing. Although these phases can overlap, each has their own noise characteristics and objective.

Distance would rapidly attenuate noise, and it is not anticipated that construction would occur close enough to existing residential areas or sensitive receptors to cause disturbances, as the Airport has purchased much of the residential property in close proximity to the airfield as part of its ongoing Noise and Land Use Compatibility Program. However, specific measures could be considered during construction to further reduce noise, including limiting the time of day heavy equipment can be operated, or ensuring that equipment is shut off when not in use.

¹⁵ The American National Standard Institute. "Quantities and Procedures for Description and Measurement of Environmental Sound – Part 4: Noise Assessment and Prediction of Long-term Community Response," 2005.

Figure 4-7 RLV Concept Flight Tracks and Sonic Boom Contours

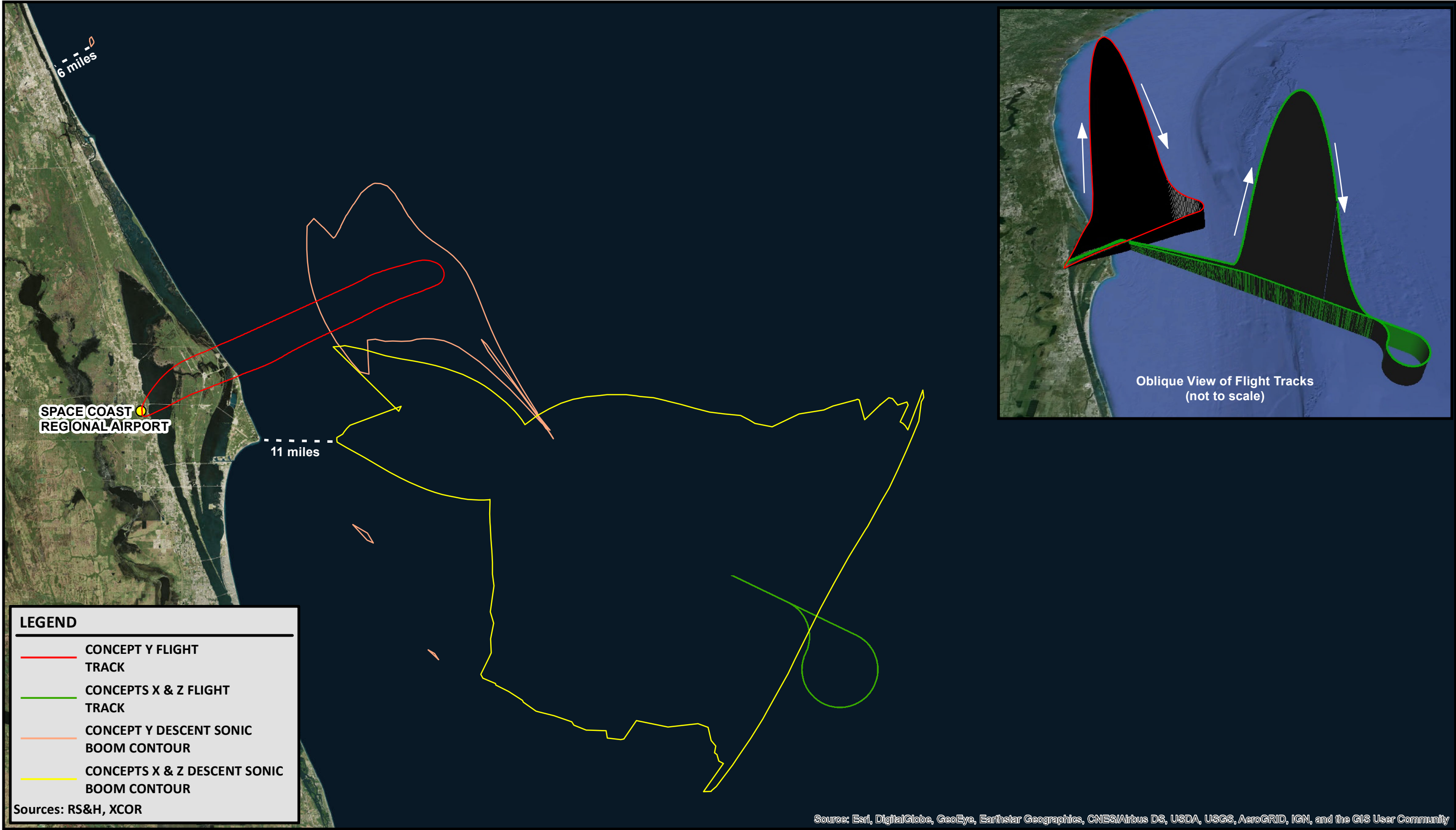


Table 4.5 Leq Noise Level (dBA) at 50 Feet for Construction Equipment	
Equipment	dBA Leq @ 50 feet
<u>Earth Moving:</u>	
Front Loader	79
Back Hoe	85
Dozer	80
Tractor	80
Scraper	88
Grader	85
Truck	91
Paver	89
<u>Materials Handling:</u>	
Concrete Mixer	85
Concrete Pump	82
Crane	83
Derrick	88
<u>Stationary:</u>	
Pump	76
Generator	78
Compressor	81
<u>Impact:</u>	
Pile Driver	100
Jackhammer	88
Rock Drill	98
<u>Other:</u>	
Saw	78
Vibrator	76
SOURCE: Grant, Charles A. and Reagan, Jerry, A., <i>Highway Construction Noise: Measurement, Prediction and Mitigation</i> .	

4.13 SOCIOECONOMICS, ENVIRONMENTAL JUSTICE AND CHILDREN'S ENVIRONMENTAL HEALTH AND SAFETY RISKS

This section describes the methodology and significance thresholds used to determine potential impacts to socioeconomics, environmental justice, and children's environmental health and safety risks resulting from the No Action Alternative and Proposed Action. As described in

Chapter 3, the ROI for this environmental impact category is the limits of the U.S. census BGs encompassing and adjacent to the Airport property.

Socioeconomics

Significance Threshold

The FAA has not established a significance threshold for socioeconomics. Factors to consider in evaluating whether impacts would be significant include whether the action would have the potential to:

- Induce substantial economic growth in an area, either directly or indirectly (e.g., through establishing projects in an undeveloped area);
- Disrupt or divide the physical arrangement of an established community;
- Cause extensive relocation when sufficient replacement housing is unavailable;
- Cause extensive relocation of community businesses that would cause severe economic hardship for affected communities;
- Disrupt local traffic patterns and substantially reduce the levels of service of roads serving an airport and its surrounding communities; or
- Produce a substantial change in the community tax base.

Environmental Consequences

As described in **Section 3.13**, the 2010 U.S. Census Bureau data shows an increase in the population of Brevard County and the U.S. Census Bureau BGs encompassing the socioeconomic ROI. The following subsections describe the potential direct and indirect socioeconomic impacts of the No Action Alternative and Proposed Action.

No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to TCAA for the operation of a launch site at TIX. Spaceport-related construction or operations would not occur. The No Action Alternative would not result in the relocation of residents or businesses. Ongoing aviation growth at TIX could continue and future operational conditions could increase over existing conditions. However, the No Action Alternative would not result in significant socioeconomic impacts.

Proposed Action

The Proposed Action would result in minor direct and indirect socioeconomic impacts. Development of the proposed RLV operator facilities would not involve land acquisition and would occur on Airport property. Accordingly, the Proposed Action would not require the relocation of residents or businesses. An RLV operator could have direct employment of 20 to 40

people. This could lead to a slight increase in the area's population as employees and their families may relocate closer to TIX. As stated in **Section 3.13**, there are 2.5 people per household in the socioeconomic ROI. Accordingly, the relocation of 20 to 40 employees to the socioeconomic ROI could potentially lead to a population increase of approximately 50 to 100 people. However, this increase would be minimal compared to the population of the socioeconomic ROI.

There is also the potential for indirect impacts. Implementation of the Proposed Action may result in some indirect, positive socioeconomic impacts (i.e., off-Airport development of commercial land uses interested in the commercial spaceport industry). However, the nature, timing, and extent of such development cannot be foreseen at this time and is not within the scope of this analysis.

Indirect impacts associated with the Proposed Action also include the potential for traffic to increase along Grissom Parkway due to employees accessing the RLV operator facilities. Assuming an RLV operator has 20 to 40 full-time employees, there could be an increase of up to 80 round trips per day. Grissom Parkway is currently Level of Service (LOS) B, based on reported average annual daily traffic volumes obtained from FDOT's Florida Traffic Online webpage utility and Comparison with FDOT LOS tables.^{16 17} The average annual daily traffic in 2017 (10,600 vehicles) is well below the threshold of LOS C (37,900 vehicles). The increase in vehicles traveling to and from the Airport would not affect the LOS of Grissom Parkway or surrounding roadways.

Overall, implementation of the Proposed Action would not have significant socioeconomic impacts.

Environmental Justice

Significance Threshold

The FAA has not established a significance threshold for environmental justice. Factors to consider in evaluating whether impacts would be significant include whether the action would have the potential to lead to a disproportionately high and adverse impact to an environmental justice population, i.e., a low-income or minority population, due to:

- Significant impacts in other environmental impact categories; or
- Impacts on the physical or natural environment that affect an environmental justice population in a way that the FAA determines are unique to the environmental justice population and significant to that population.

¹⁶ FDOT, FDOT Florida Traffic Online 2017, <https://tdaappsprod.dot.state.fl.us/fto/>, (March 7, 2019).

¹⁷ FDOT "2013 Quality /Level of Service Handbook," <https://www.fdot.gov/planning/systems/documents/sm/default.shtm#los>, 2013 (March 7, 2019).

Environmental Consequences*No Action Alternative*

Under the No Action Alternative, the FAA would not issue a launch site operator license to TCAA for the operation of a launch site at TIX. Spaceport-related construction or operations would not occur. Ongoing aviation growth at TIX could continue and future operational conditions could increase over existing conditions. However, the No Action Alternative would not result in significant environmental impacts that would adversely affect any population. Therefore, there would be no disproportionately high or adverse impacts to minority or low-income populations, and environmental justice impacts would be less than significant.

Proposed Action

The Proposed Action would occur entirely on Airport property. Area residents and/or businesses would not need to be relocated. There are no minority or low income families within the Proposed Action's future aviation noise contours. Based on the analysis of other environmental categories, such as air quality, hazardous materials, water resources, etc., there would not be significant impacts. Therefore, there would be no disproportionately high or adverse impacts to minority or low-income populations, and environmental justice impacts would be less than significant.

Children's Environmental Health and Safety Risks**Significance Threshold**

The FAA has not established a significance threshold for children's environmental health and safety risks. Factors to consider in evaluating whether impacts would be significant include whether the action would have the potential to lead to a disproportionate health or safety risk to children.

Environmental Consequences*No Action Alternative*

Under the No Action Alternative, the FAA would not issue a launch site operator license to TCAA for the operation of a launch site at TIX. Spaceport-related construction or operations would not occur. Ongoing aviation growth at TIX could continue and future operational conditions could increase over existing conditions. However, the No Action Alternative would not result in a disproportionate health or safety risk to children. Accordingly, impacts related to children's environmental health and safety risks would be less than significant.

Proposed Action

As described in **Chapter 2**, the development associated with the Proposed Action would occur entirely on Airport property. Surrounding residents and/or businesses would not be required to relocate and the surrounding community would not be disrupted. Operation of the Proposed Action would occur in a secured and controlled environment and children would not access the site. Additionally, the Proposed Action would not result in significant environmental impacts that would adversely affect any population, including children. Therefore, impacts related to children's environmental health and safety risks would be less than significant.

4.14 WATER RESOURCES

Wetlands

Significance Threshold

Impacts would be significant if the action would:

- Adversely affect a wetland's function to protect the quality or quantity of municipal water supplies, including surface waters and sole source and other aquifers;
- Substantially alter the hydrology needed to sustain the affected wetland system's values and functions or those of a wetland to which it is connected;
- Substantially reduce the affected wetland's ability to retain floodwaters or storm runoff, thereby threatening public health, safety or welfare (the term welfare includes cultural, recreational, and scientific resources or property important to the public);
- Adversely affect the maintenance of natural systems supporting wildlife and fish habitat or economically important timber, food, or fiber resources of the affected or surrounding wetlands;
- Promote development of secondary activities or services that would cause the circumstances listed above to occur; or
- Be inconsistent with applicable state wetland strategies.

Environmental Consequences

No Action Alternative

The No Action Alternative would not include new construction for spaceport-related development. Therefore, no spaceport-related wetland impact would occur as a result of the No Action Alternative. Normal growth and associated airport development would continue at TIX, and some projects might impact wetlands under jurisdiction of SJRWMD or the USACE, but such projects would be required to obtain the appropriate permits and provide mitigation to offset unavoidable impacts.

Proposed Action

The Proposed Action would avoid direct impacts to wetlands (**Figure 4-8**). Indirect impacts to wetlands would be expected to be avoided or to be minor in nature. Buffers more than 25 feet wide that could filter sediment or other pollutants in runoff would remain in place around all wetlands that occur near construction. In addition, sediment and erosion control measures would be used during construction to minimize the likelihood of sediment movement beyond the construction area and being washed into wetlands.

Once the project is constructed and operations have begun, the stormwater management facilities constructed for the project would ensure that stormwater is treated according to the State of Florida's requirements, so that pollutants are not introduced into wetlands near the spaceport facilities. In the unlikely event of a launch failure, any potential impacts to wetlands would be minimized by emergency response and clean-up procedures as described in the Airport Certification Manual.

Compensatory mitigation for wetland impacts is not anticipated as there would be no direct wetland impacts (i.e., permanent fill placement) and potential indirect impacts would be avoided or be minimal. This would be evaluated/confirmed during the final design and permitting phase of the project. In summary, no significant wetland impacts are anticipated.

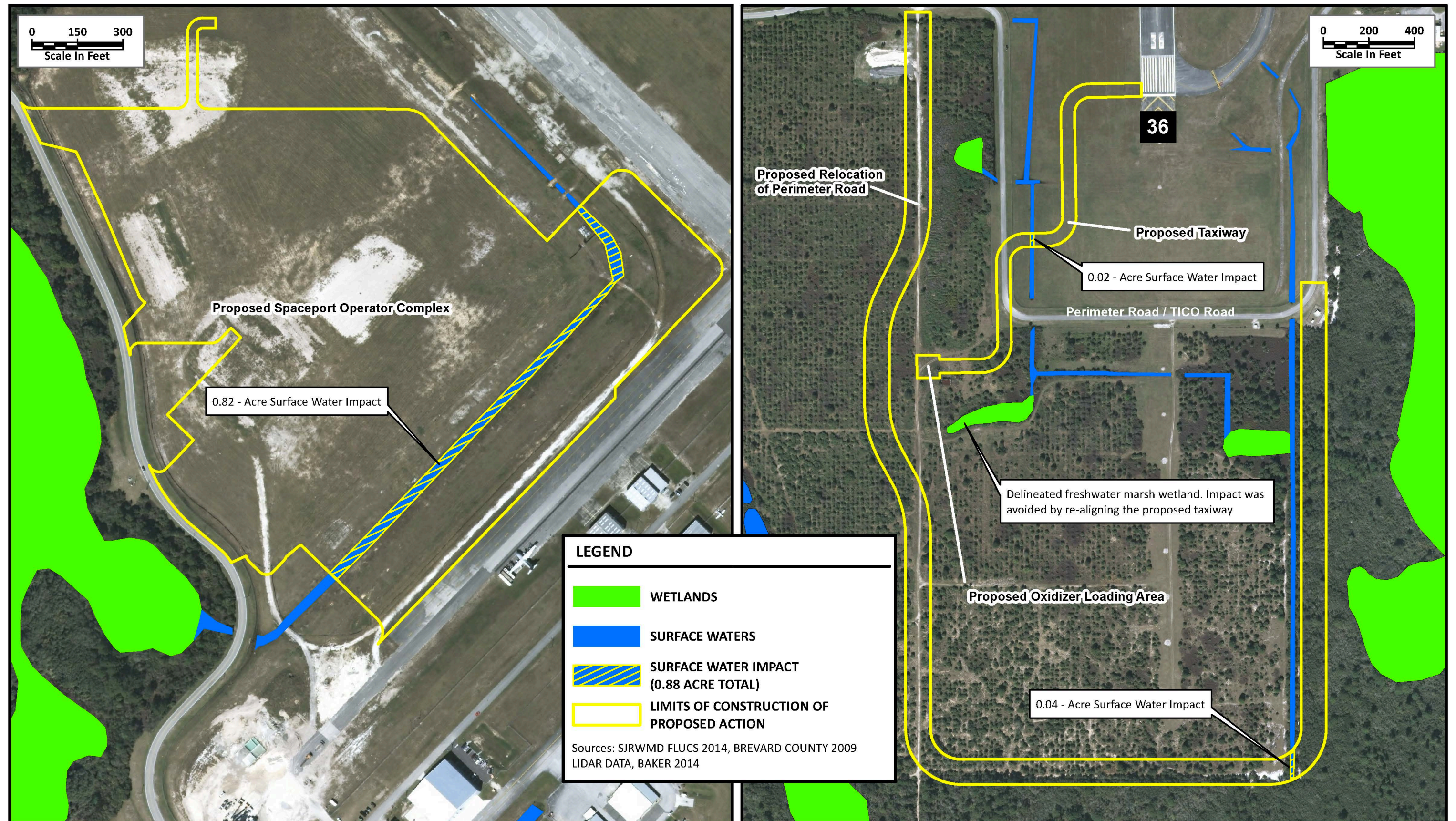
Floodplains**Significance Threshold**

Impacts would be significant if the action would cause notable adverse impacts on natural and beneficial floodplain values. Natural and beneficial floodplain values are defined in Paragraph 4.k of DOT Order 5650.2, Floodplain Management and Protection.

Environmental Consequences*No Action Alternative*

Under the No Action Alternative, the FAA would not issue a launch site operator license to TCAA and there would be no RLV operations from TIX. There would be no spaceport-related construction and no spaceport-related impacts to floodplains. Normal growth and associated airport development at TIX would continue and some future projects might have impacts to floodplains, but such projects would incorporate compensation for floodplain storage capacity as required.

Figure 4-8 Surface Water Impacts



Proposed Action

As discussed in **Chapter 2** of this EA, the Proposed Action is the only practicable alternative that meets the purpose and need for the project. The construction limits would encroach on approximately 3.2 acres of the 100-year floodplain (Zone A). As depicted in **Figure 4-9**, the majority of the floodplains near the construction ROI are located west of Perimeter Road; however, the limits of the 100-year floodplain do extend east across Perimeter Road on the west side of the spaceport operator complex, and this is where the encroachment would occur. The proposed development within the 100-year floodplain would consist of the west corner of the proposed new hangar that would be used for RLV manufacturing and hybrid rocket fuel storage, the loading dock/freight delivery area on the southwest side of the hangar, a portion of an access drive, and a portion of the stormwater pond associated with the spaceport operator complex. The RLV manufacturing hangar would either be built two feet in elevation above the 100-year flood elevation or would be built to the 500-year flood elevation. This will be determined during final design.

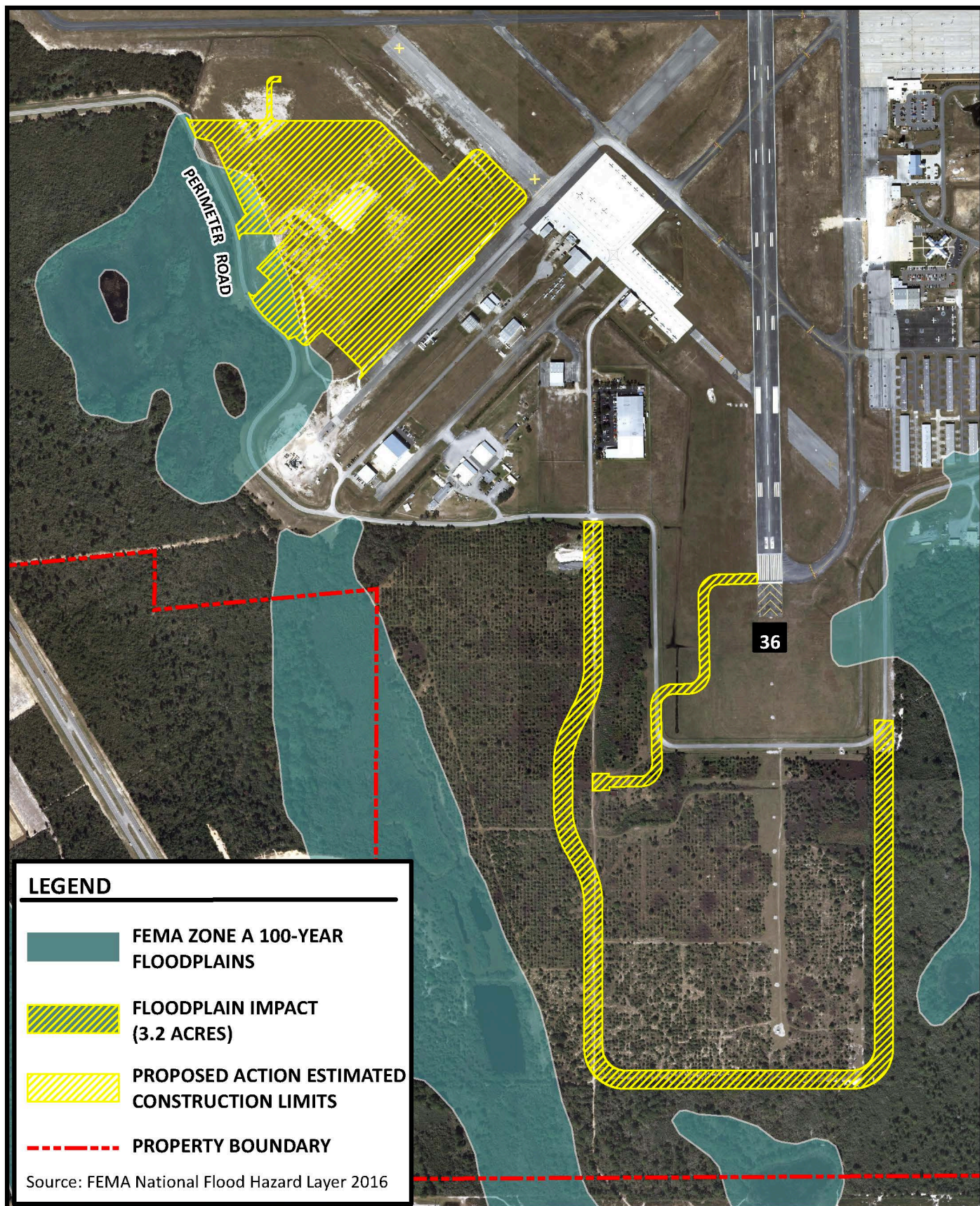
If not mitigated, the Proposed Action's floodplain impacts would result in decreased flood storage capacity, and could result in a slight decrease in recharge to the surficial aquifer. Although the proposed RLV manufacturing facility/hangar, parking lot, apron, and oxidizer and fuel storage areas would add impervious surfaces, the proposed stormwater pond would provide stormwater storage capacity and be designed to capture the runoff from these facilities to allow for percolation of stormwater to the surficial aquifer.

One to one ratio (volume) floodplain compensation would be required by the SJRWMD for the issuance of the Environmental Resource Permit, and therefore would be incorporated into the final design for the construction. This compensation would offset impacts to the storage functions of the impacted area of floodplains.

Significance of floodplain encroachment was evaluated with respect to the three criteria from DOT Order 5650.2:

- (1) The floodplain encroachment from construction would not be anticipated to increase the probability of loss of human life. The area of floodplain that would be affected is one that is associated with wetlands that are not directly connected to any stream systems. This area is completely contained within TIX property and there is no residential development in the vicinity of this floodplain. Flooding within and to the limits of the 100-year floodplain in this area would not require evacuations of any dwellings.

Figure 4-9 100-Year Floodplain Impact



(2) Damage associated with flooding to the limit of the 100-year floodplain in this area would be anticipated to be minimal. Because construction would include one to one ratio flood storage compensation and because the RLV manufacturing facility/hangar would either be built two feet above the 100-year flood elevation or to the 500-year flood elevation, no flooding of this building would be anticipated during a 100-year flood event. One pre-existing road, Perimeter Road, is within the limits of this area of 100-year floodplain but flooding of this road during a 100-year flood event would occur whether or not the facilities associated with the Proposed Action are constructed. Additionally, this road is not a major thoroughfare or designated evacuation route, and it is anticipated that in the event of over-road flooding on Perimeter Road, traffic could be diverted until floodwaters have receded.

(3) Impacts to beneficial floodplain values are anticipated to be minor. The Proposed Action's floodplain impacts would not affect floodplain-related agricultural value or aquaculture activities that are dependent on water supply or water quality benefits provided by floodplains. The portion of the floodplain that would be impacted has been previously cleared of vegetation, aside from turfgrass, and provides little in the way of wildlife habitat.

Because the Proposed Action would be unlikely to result in increased probability of loss of human life from flooding, would be unlikely to result in flood-related property damage, and would not result in notable impacts to natural and beneficial floodplain values, FAA concludes that no significant floodplain encroachment would result from the Proposed Action.

Surface Waters

Significance Threshold

Impacts would be significant if the action would exceed water quality standards established by federal, state, local, and tribal regulatory agencies; or contaminate public drinking water supply such that public health may be adversely affected. Additional factors to consider include whether the action would have the potential to:

- Adversely affect natural and beneficial water resource values to a degree that substantially diminishes or destroys such values;
- Adversely affect surface waters such that the beneficial uses and values of such waters are appreciably diminished or can no longer be maintained and such impairment cannot be avoided or satisfactorily mitigated; or
- Present difficulties based on water quality impacts when obtaining a permit or authorization.

Environmental Consequences

No Action Alternative

The No Action Alternative would not include new construction for spaceport-related development. Therefore, no spaceport-related impact to surface waters would occur and no impervious surface for spaceport infrastructure would be constructed as a result of the No Action Alternative. Normal growth and airport development would continue, and some projects might have impacts to surface waters. Such projects would obtain the necessary permits and provide appropriate treatment and attenuation for stormwater runoff as well as required mitigation for direct impact to surface waters subject to the jurisdiction of the SJRWMD or USACE.

Proposed Action

Construction would result in the creation of approximately 36 acres of new impervious surfaces, including a hangar and associated structures, parking lots and roads, a new apron, and a new taxiway and oxidizer loading area. Stormwater from the proposed construction sites and the new impervious surfaces would drain to the Delespine Grant Ditch sub-watershed within the Upper St. Johns River watershed and to the proposed onsite stormwater pond for percolation. None of the surface waters within the Delespine Grant Ditch sub-watershed are 303(d)-listed as impaired waters.

Construction would result in direct impact to 0.88 acre of existing man-made ditches that may be claimed as jurisdictional waters of the U.S. and state-jurisdictional surface waters during the permitting phase of the construction. One or more CWA Section 404 Permits from the USACE and ERP from the SJRWMD would be required, depending on how the construction projects are scheduled. As part of the ERP review process, the SJRWMD considers potential for indirect water quality impacts. Applicants must demonstrate that suitable sediment and erosion control measures will be implemented during construction to receive the ERP permit approval.

Furthermore, the construction design is reviewed to ensure that it provides appropriate facilities for the treatment of stormwater runoff to protect surface waters during the operational phase of the project. If additional mitigation is required for potential surface water impact, this will be a stated condition of the issuance of the permits. CWA Section 401 Water Quality Certification is issued by the SJRWMD jointly with the ERP permit. This certification will not be issued and the permit will not be approved unless the reviewing agency determines the design includes appropriate measures to ensure state water quality standards are met. Therefore, the improvements would be designed accordingly to incorporate suitable water quality protection measures to avoid indirect impacts.

Construction would also be required to have a NPDES permit. This is a requirement that originates from Section 402 of the CWA, but like Section 401 certification, NPDES permitting

authority has been delegated to the FDEP. As a requirement of the NPDES permit, the airport's contractor would be required to develop and implement a Stormwater Pollution Prevention Plan (SWPPP) for the construction phase of each construction project. This plan would include best management practices to prevent erosion of disturbed soils during construction, plans for preventing and responding to spills at the construction site, standards for handling materials to reduce likelihood of spills, and other measures for protecting surface waters near the construction site. Construction activities would comply with FAA Advisory Circular 150/5370-10C entitled *Standards for Specifying Construction of Airports*, specifically Item P-156, *Temporary Air and Water Pollution, Soil Erosion, and Siltation Control*. Given the above procedures, no significant impacts to water quality from construction are anticipated.

After construction is complete, operational activities at the new facilities would be conducted in accordance with the airport's operational SWPPP, which, similar to the construction contractor's SWPPP, contains best management practices for storage and handling of materials to reduce the likelihood of spills and pollution of stormwater runoff. If a launch failure were to occur, potential impacts to inland surface waters would be minimized by emergency response and clean-up procedures as described in the Airport Certification Manual. If the failure occurred over the Atlantic Ocean, it would likely originate from high altitude, and potentially released pollutants such as RP-1 that fall to the ocean surface would be quickly dispersed at very low concentrations that would not result in noticeable impacts to water quality. Released oxidizers would likely vaporize, and solid fuels such as ABS plastic or HTPB that remain unspent would not be expected to affect water quality.

The launch, landing, and operation of RLVs is not anticipated to have any significant impact on surface water or surface water quality. Given the many levels of permitting requirements and regulations directly related to water quality protection that would have to be satisfied to construct and operate the facilities associated with the Proposed Action, no significant surface water or surface water quality impacts are anticipated.

Groundwater

Significance Threshold

Impacts would be significant if the action would:

- Exceed groundwater quality standards established by federal, state, local, and tribal regulatory agencies, or
- Contaminate an aquifer used for public water supply such that public health may be adversely affected.

Additional factors to consider include whether the action would have the potential to:

- Adversely affect natural and beneficial groundwater values to a degree that substantially diminishes or destroys such values;
- Adversely affect groundwater quantities such that the beneficial uses and values of such groundwater are appreciably diminished or can no longer be maintained and such impairment cannot be avoided or satisfactorily mitigated; or
- Present difficulties based on water quality impacts when obtaining a permit or authorization.

Environmental Consequences

No Action Alternative

The No Action Alternative would not include new construction for spaceport-related development. Therefore, there would be no associated potential for excavation below the water table and there would be no spaceport-related impervious surface to decrease infiltration and percolation of water to the aquifer underlying the airport. Normal growth and airport development would continue at TIX under the No Action Alternative. Some development projects might have the potential to require excavation below the water table, but such projects would take appropriate measures to minimize potential impacts to groundwater. Construction projects would implement construction SWPPPs and SPCC Plans as needed to protect groundwater resources. Additionally, the best management practices included in the airport's operational SWPPP and SPCC Plan would be employed to minimize the likelihood that soils and groundwater would be contaminated as a result of mishandling or improper cleanup of pollutant spills if and when they occur as part of normal airport operations.

Proposed Action

Construction would have the potential to disturb some soils below the water table but would use clean fill materials where fill is necessary to avoid negative impacts to groundwater quality. Under the NPDES permit for construction, the contractor would be required to implement a construction SWPPP and a construction SPCC Plan to protect surface waters and groundwater from pollution. Once the spaceport operator complex is constructed, the airport's SWPPP would be updated to reflect additional best management practices to ensure the risk of soil and groundwater contamination is minimized. In the unlikely event of a launch failure, any potential impacts to groundwater would be minimized by emergency response and clean-up procedures as described in the Airport Certification Manual.

The proposed stormwater pond would be designed to allow stormwater to be captured for treatment and percolation to the surficial aquifer. This would offset some of the increased runoff created by the estimated 36 acres of new impervious surfaces that would be created by

construction of the RLV manufacturing facility/hangar, parking lots and roads, apron, oxidizer storage area, liquid fuel storage area, new taxiway and new oxidizer loading area. The design of facilities to be constructed would be evaluated by the SJRWMD during the ERP process. The permit would not be issued until the SJRWMD is satisfied that appropriate treatment of runoff is provided.

In summary, no significant impact to groundwater resources are anticipated.

CHAPTER 5

CUMULATIVE IMPACTS

Cumulative impacts are defined by CEQ (40 CFR §1508.7) as:

“The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.”

Per CEQ’s cumulative impacts guidance,¹ “each resource, ecosystem and human community must be analyzed in terms of its ability to accommodate additional effects, based on its own time and space parameters.” The cumulative effects analysis must therefore consider effects that may occur in areas that are not necessarily located immediately adjacent to the project area. In considering the potential for cumulative impacts associated with the Proposed Action, effects were primarily considered relative to the ROIs defined in **Chapter 3**.

For many of the impact categories analyzed in the EA, there would be no direct or indirect impacts (or only negligible effects), and therefore the Proposed Action would not result in cumulative impacts on those impact categories. Impact categories for which the Proposed Action would not result in cumulative impacts include the following:

- Air quality;
- Coastal resources;
- Farmlands;
- Hazardous materials, solid waste, and pollution prevention;
- Historical, architectural, archeological, and cultural resources;
- Land use;
- Natural resources and energy supply;
- Environmental justice and children’s environmental health and safety risks;
- Visual effects (including light emissions);

¹ Council on Environmental Quality, “Considering Cumulative Effects Under the National Environmental Policy Act,” <http://www.slideshare.net/whitehouse/considering-cumulative-effects-under-nepa>, 1997 (March 10, 2019).

- Wetlands;
- Groundwater; and
- Wild and scenic rivers.

The impact categories analyzed for potential cumulative impacts include the following:

- Biological resources;
- Climate;
- Department of Transportation Act, Section 4(f);
- Noise and noise-compatible land use;
- Socioeconomics;
- Floodplains; and
- Surface waters.

5.1 METHODOLOGY

To assess past, present, and reasonably foreseeable future actions at or near TIX, the following documents and data were reviewed:

- Joint Airport Capital Improvement Program list for TIX
- Brevard County Budget Office Capital Improvement Plan for fiscal year (FY) 2018 to 2019²
- Spacecoast Transportation Planning Organization Transportation Improvement Program FYs 2016–2020,³ and Spacecoast Transportation Planning Organization Transportation Improvement Program FYs 2018/2019–2022/2023.⁴
- GIS data layers depicting Planned Unit Developments and Developments of Regional Impact
- Press releases from the City of Titusville
- Historical aerial photography in the vicinity of TIX

A list of past, present, and reasonably foreseeable future actions was developed as follows.

² Brevard County, Budget Office Capital Improvement Plan, <http://www.brevardfl.gov/Budget/CIP>, December 19, 2018 (March 10, 2019).

³ Space Coast Transportation Planning Organization, *Transportation Improvement Program FY 2016 - FY 2020*, <http://spacecoasttpo.com/wp-content/uploads/2015/07/FINAL-TIP-FY-2016-2020.pdf>, July 9, 2015 (March 10, 2019).

⁴ Space Coast Transportation Planning Organization, *Transportation Improvement Program FY 2018/2019 - FY 2022/2023*, https://spacecoasttpo.com/wp-content/uploads/2018/12/TIP-FY-19-23-TIP-Amended-12_13_18.pdf, amended December 13, 2018, (March 10, 2019).

5.1.1 Past Actions

Projects constructed in the past ten years at TIX include the following:

- Air Rescue and Fire Fighting Facility building and parking lot
- 1.4-acre east apron
- Eastside corporate hangar and parking lot adjacent to the east apron
- TIX Administration Building
- 8.7-acre west apron
- 0.8-acre Administration Building apron
- Bristow helicopter training facility (40,000 square-foot hangar and 9-acre apron)
- 50,000 square foot Embraer Aero Seating Technologies manufacturing facility⁵
- 67,000 square foot Paragon Plastics manufacturing facility⁶
- 246,240 square foot Canaveral Port Authority warehouse at the Titusville Logistics Center⁷

5.1.2 Present Actions

At the time this EA was published, there were no known large-scale actions occurring at or near TIX. However, small-scale commercial and residential developments are ongoing in the region. The closest known commercial development under construction is the Towneplace Suites by Marriott. The hotel is under construction at the north east corner of the junction of Interstate 95 and route 50, approximately 6.5 miles from TIX.

5.1.3 Future Actions

Upcoming projects planned at TIX within the next five years include the following:

- Rehabilitation of Runway 9-27
- Construction of new Taxiway G that will parallel Runway 36 and extend from the approach end of Runway 36 to Runway 27
- Construction of a northward extension of Taxiway A to the end of Runway 18 to provide a full parallel taxiway.
- Construction of a new one-acre apron adjacent to existing hangars northeast of connector Taxiway A2.

⁵ Aerospace Manufacturing and Design, Embraer Aero Seating Technologies Opens New Manufacturing Facility, <http://www.aerospacemanufacturinganddesign.com/article/embraer-aero-seating-technologies-opens-titusville-092016/>, September 20, 2016 (March 10, 2019).

⁶ Brevard Business News, SBA 504 program helps Paragon Plastics expand with new plant in Titusville <http://brevardbusinessnews.com/ArchiveDocs/2018/2018-01-01/BBN-010818.pdf>, January 8, 2018 (March 10, 2019).

⁷ Florida Today, "Port Canaveral Titusville Logistics Center Underway," <http://www.floridatoday.com/story/news/local/2015/07/27/port-canaveral-titusville-logistic-center-underway/30748585/>, July 27, 2015 (March 10, 2019).

Additional upcoming off-airport development in the general vicinity of TIX includes:

- Construction of a 75,000 square-foot building shell in Spaceport Commerce Park approximately one mile northwest of the construction ROI for recruiting a new or expanding industry to the area.
- Future build out of the remainder of the 320-acre Titusville Logistics Center site approximately 0.58 mile east of the construction ROI. This will likely proceed gradually as dictated by demand for multimodal warehouse/industrial space arises and will likely continue beyond the 5-year window of the cumulative impact assessment.

5.2 SIGNIFICANCE THRESHOLD

The significance thresholds for the environmental impact categories included in this cumulative impacts analysis are the same as those identified in **Chapter 4**.

5.3 ENVIRONMENTAL CONSEQUENCES

Potential cumulative impacts to the impact categories assessed in this cumulative impacts analysis are discussed below.

Biological Resources

The past, present, and reasonably foreseeable future actions identified above have resulted in or will result in minor impacts to terrestrial habitat, as the habitat is converted from undeveloped uplands to developed areas. In some cases, developments are occurring in areas that have previously been cleared of vegetation and disturbed, so the development or further new development on the site did not or would not necessarily result in recent or new habitat impacts. Given the previous disturbance, and given the location is an airport, the habitat at TIX is not high-quality wildlife habitat. There is wildlife habitat available in the area surrounding TIX, particularly to the southwest of TIX (**Figure 2-1a**). As described in **Section 4.3**, habitats that would be impacted by the Proposed Action are largely already disturbed habitats. Implementation of the *“Standard Protection Measures for the Eastern Indigo Snake”* would ensure no adverse effects to this species. The Proposed Action, in combination with past, present, and reasonably foreseeable future projects, would not jeopardize the continued existence of any ESA-listed species or result in major effects to population dynamics, reproductive success rates, or mortality rates of state-protected species or other native wildlife species. The potential for minor cumulative impacts to one state-protected species, the gopher tortoise, exists, but any impacts would be mitigated by obtaining a gopher tortoise conservation permit, excavating burrows within 25 feet of the limits

of construction, and relocating any tortoises captured to an FWC-approved gopher tortoise recipient site per the conditions of the permit. Such sites are carefully selected and must demonstrate they have suitable habitat and sufficient forage to support gopher tortoises. As a result, impacts to gopher tortoises would be minor. In summary, the Proposed Action would not result in significant cumulative impacts to biological resources.

Climate

Past, present, and reasonably foreseeable future projects emit GHG (CO₂). Similarly, CO₂ is emitted during RLV operations. Estimated annual GHG emissions associated with the Proposed Action for each year of the proposed launch site operator license (2020 to 2025) are presented in **Chapter 4**. The estimated emissions from the Proposed Action represent only a tiny fraction of total GHG emissions generated in the U.S.

The small quantity of GHG emissions from the Proposed Action alone would not cause appreciable global warming impacts that would lead to climate change. These emissions would increase the atmosphere's concentration of GHGs which, in combination with past, present, and reasonably foreseeable future emissions from other sources, could contribute incrementally to global warming and the resultant adverse effects of climate change. Currently there is no methodology to enable estimation of specific impacts of this incremental warming.

Department of Transportation Act, Section 4(f)

The FAA has determined the Proposed Action would not substantially diminish the protected activities, features, or attributes of any of the Section 4(f) properties identified and would not result in substantial impairment of the properties. Therefore, the Proposed Action would not be considered a constructive use of these Section 4(f) properties and would not result in significant impacts. The projects considered would have the potential to have only minor affects to the acoustic environment in the vicinity of TIX. The Section 4(f) resources that are located near the vicinity of the projects are the Enchanted Forest Sanctuary, Tom Statham Park, and Manatee Hammock Campground. For foreseeable projects, construction noise would occur and be perceivable in areas in close proximity to the construction site, but this noise would be temporary. Also, because these projects would not be constructed simultaneously, the construction noise from these projects would not be additive. Other noise caused by aircraft operations at TIX was modeled through 2023 as part of the noise analysis for this EA. The projects included in the cumulative impacts analysis, such as the construction of new taxiways and a new apron, would not result in an increase in number of aircraft operations or a change in the fleet mix at TIX. Therefore, no significant change in the noise environment in the vicinity of the Enchanted Forest would occur. The Proposed Action in conjunction with past, present, and reasonably foreseeable future actions would not result in significant cumulative impacts to Section 4(f) properties.

Socioeconomics

Induced socioeconomic impacts from past, present, and reasonably foreseeable actions in the vicinity of TIX are anticipated to be minor but positive. The proposed projects that have or would be constructed at TIX do not involve new property acquisition or the introduction of land use incompatibilities. Growth at and in the vicinity of TIX has the potential to create new jobs, which is highly beneficial to the area that was negatively affected by the discontinuation of the space shuttle program and the attendant loss of jobs. As discussed in **Chapter 4**, the Proposed Action has the potential to result in the addition of 20 to 40 new jobs. The off-airport projects listed above have also created approximately 65 jobs and have the potential to create an additional 850 to 950 jobs. The discontinuation of the space shuttle program is estimated to have resulted in the loss of 7,000 jobs at Kennedy Space Center,⁸ with many of these employees moving out of the area. As such, the additional jobs that would be created by the Proposed Action and other projects evaluated in this cumulative impacts analysis would not be anticipated to result in a shortage of housing or resources. Further, they would be anticipated to help offset some of the negative impact to the local economy that was caused by the changes at NASA. Therefore, the Proposed Action, in combination with past, present, and reasonably foreseeable projects, would be anticipated to result in minor but beneficial induced socioeconomic impacts.

Noise and Noise-Compatible Land Use

The past, present, and reasonably foreseeable future actions could result in increased noise to the surrounding area during construction activities. An increase in construction noise occurs only as long as the construction activities are underway. A cumulative construction noise impact would not occur because the projects would not occur at the same time.

When modeling future aviation noise at an airport, two of the more important data inputs are the increase in the number of average daily operations and the aircraft fleet mix (i.e., types of aircraft). At this time, the forecast of average daily operations and the aircraft fleet mix has not been quantified. However, none of the anticipated future projects at TIX for the period of the cumulative impact analysis would be anticipated to significantly increase the number of average daily operations. No major changes to the aircraft fleet mix operating at TIX are anticipated. Therefore, the Proposed Action would not result in significant noise impacts.

Floodplains

The past actions identified above are all located in areas outside of the FEMA designated 100-year floodplain. In addition, the Embraer facility and the Paragon Plastics facility, within the Spaceport Commerce Park, and the new Canaveral Port Authority warehouse within the Titusville

⁸ CBS News, Jobs, Dreams Lost After Space Shuttle Program Ends, <http://www.cbsnews.com/news/jobs-dreams-lost-after-space-shuttle-program-ends/>, March 29, 2012 (March 10, 2019).

Logistics Center, are located outside the FEMA 100-year floodplain boundary. However, future construction that may occur in the southwest portion of the Titusville Logistics Center has the potential to result in encroachment on the 100-year floodplain. It is unknown whether the 75,000-foot industrial shell proposed for construction within the Spaceport Commerce Park would impact floodplains, because its precise location within the industrial park was not available for review. None of the future projects at TIX other than the Proposed Action have potential to impact FEMA 100-year floodplains.

For each of the projects that has the potential to result in encroachment on the 100-year floodplain, impacted floodwater storage volume will have to be replaced at a one to one ratio in order to attain the necessary permits from the SJRWMD. Additionally, the stormwater treatment functions that would normally be provided by the impacted floodplain would have to be mitigated by the construction of the stormwater treatment system for each project. Buildings that would be constructed under each project would either be constructed two feet above the 100-year floodplain elevation or at the 500-year floodplain elevation. By compensating for lost flood storage and by constructing new buildings above the 100-year floodplain elevation, the projects are not anticipated to result in an increased likelihood of property damage in the event of a 100-year flood.

None of the projects with the potential to encroach on 100-year floodplains is located near an area of residential development, and because one to one volume flood storage capacity would be provided, there would be no increased flooding risk and no increased possibility of flood-related human fatalities.

No hurricane evacuation routes are located in close proximity to the past, present, and reasonably foreseeable future projects that have the potential to encroach on floodplains.

Impacts to beneficial floodplain values are anticipated to be minor. The Proposed Action's floodplain impacts would not affect floodplain-related agricultural value or aquaculture activities that are dependent on water supply or water quality benefits provided by floodplains. The portion of the floodplain that would be impacted has been previously cleared of vegetation, aside from turfgrass, and provides little in the way of wildlife habitat.

Taking the above into consideration, the Proposed Action would not result in significant cumulative floodplain impacts.

Surface Water

Each of the past, present, and reasonably foreseeable future actions had or has the potential to result in water quality impacts during the construction phase. This could be the result of accidental spills at the construction site or failure of sediment and erosion control measures to

treat runoff in situations such as a severe storm event that overwhelms those measures. These potential negative effects are addressed by existing permitting mechanisms. As discussed in **Section 4.14**, Environmental Resource Permitting requirements seek to ensure that proper controls are in place to minimize erosion and sedimentation and that treatment of stormwater is provided for stormwater ponds. Additionally, construction activities at these facilities were or will be required to operate under the conditions of an NPDES Permit, SWPPP, and SPCC Plans to help ensure that state water quality standards are not violated.

Minor direct surface water impacts to USACE- and SJRWMD-jurisdictional ditches would occur as a result of the Proposed Action. Some of the other past, present, and reasonably foreseeable future projects would also have direct impact to surface waters. As part of the USACE and SJRWMD permitting process, the potential for cumulative impacts is evaluated. If potential for cumulative impacts is identified, the permittee's mitigation plan is required to compensate for those cumulative impacts.

Taking the above into consideration, the Proposed Action is not expected to result in significant cumulative surface water impacts.

CHAPTER 6

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CHAPTER 7

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